OIL & FAT INDUSTRIES

The Editor's Page

Why Substitutes?

OUR Federal Government bureaus should be leaders in the constructive thought of the Nation, and, we feel, should avoid carelessness of designation in official documents, particularly where such carelessness is likely to implant or perpetuate unreasoning prejudices in the public mind.

A case in point is a recently issued report of the Bureau of the Census announcing the total production of "Lard Substitutes" and Vegetable Cooking Oils in 1929. We object most emphatically to this implied accusation that more than a billion pounds of wholesome, clean refined vegetable and animal fat products were produced only as "substitutes" for the fat of the hog.

Lard is lard, shortening is shortening. Lard may be shortening, but shortening does not have to be lard. Any assumption that a shortening or cooking fat must be a "lard substitute" is not only wrong per se, in the light of modern knowledge, but is also without foundation upon any historical fact. That the peoples of antiquity used olive oil, sesame oil and the fat of goats and sheep for frying and shortening purposes long before swine were domesticated, is a matter of common knowledge. Should the official language of our Government Bureaus be permitted thus tacitly to condemn as "substitutes" an entire class of food products which are sold to the consuming public solely upon quality and merit and without claim of substitution for any other competing product?

Shortening and cooking fats may be produced by rendering the fat of various domestic animals, by blending such fats with selected vegetable oils, or by refining the vegetable oils alone, or by refining and hydrogenating these or other vegetable oils. It is surely not readily apparent why one of these shortening and cooking fats, namely lard, should be selected by the Bureau of the Census for the honor of an individual name, while all the others, though just as wholesome and suitable for their purpose, and sold in volume at least of the same order of magnitude, must be content with the sweeping designation of "substitute." This seems to us to belong in that class of reasoning which might call the automobile a substitute for the horse and buggy.

That the "man in the street" can be deceived by specious reasoning is a foregone conclusion, and for this reason, those who prepare our Government census bulletins should exercise especial effort to avoid inaccuracy in the wording of their documents.

A suggestion from manufacturers of shortening may be all that would be required.

Scraping Bottom

THE turn of the year saw the world's animal and vegetable oil prices at the lowest ebb since 1913, in some cases even lower than the average which prevailed in that year. Lard and linseed oil, the indicators of trends in the edible and technical fields respectively, both closed the year with outstanding weakness. Tallow, the soapmaker's barometer, seemed to be an outcast, with no demand at any price, certainly none at any price which would leave the producer a margin of profit. Cottonseed oil, second only to lard in volume in this country, was moving sluggishly to a market which was none too anxious to absorb even light offerings. China wood oil met no demand and fish oils likewise were unpopular.

In seeking the reason for these extremely low prices, we have encountered the usual long-familiar explanations. They are uniformly to the effect that world stocks of oils, fats and oil-bearing seeds are extremely large, in the face of a demand far below normal.

To us this time-worn excuse leaves much unexplained, for after all the ultimate customer demand can not have been entirely assuaged by volumes of material but little, if any, greater than those delivered to consumption in the previous year. The population of the world is not decreasing in these times of almost universal peace, so the demand for edible and inedible fats cannot possibly cease, or be cut in half, or even be reduced by one-quarter, all of a sudden.

It would appear, rather, that those who purchase the raw oils and fats for conversion into consumer products are "playing" the psychology of business depression to the limit against the unwary producer of these raw materials. We believe that an impartial survey of the warehouses of these converting oil refiners and soap manufacturers would reveal that they are scraping the bottoms of their bins and tanks, just as prices are scraping the bottom of the market. This is, of course, the canny course for them to pursue, just as long as they are able to get deliveries and fill their orders, and just as long as they all adhere to the formula.

If, however, one or two of the larger refiners and soapmakers should decide that stocks need replenishment, there will be a great scramble for protection against a sudden substantial rise in the market.

In such event, some manufacturers may find themselves filling contracts from raw materials which have cost so dearly that no margin is left for profit, or possibly even for manufacturing and distributing costs.

Chemists Elect Redman

Dr. Lawrence V. Redman, Vice-president and Director of Research of the Bakelite Corporation, has been chosen president-elect of the American Chemical Society for 1932. Dr. Redman will succeed professor Moses Gomberg of the University of Michigan, who is president for 1931, having been chosen president-elect a year ago, according to the custom of the society.

Dr. Redman is well known in chemical circles throughout the country, particularly for his work on synthetic resins. He is president of the Chemists' Club of New York, a member of the American Institute of Chemical Engineers, the American Association for the Advancement of Science, the Society of Chemical Industry and the Chemists' Club of Chicago.

The Corn Products Refining Company has declared an extra dividend of 50 cents and the regular quarterly dividend of 75 cents a share on the common stock payable January 20 to stock of record January 5. The usual quarterly dividend of $1.75 a share was declared on the preferred shares, payable January 15 to stock of record January 5. At this time last year the company paid an extra dividend of 75 cents a share on the common stock in addition to the regular disbursements.

Shortening and Oil Prices

Prices of shortening and salad and cooking oils on Thursday, Dec. 18, 1930, based on sales made by member companies of the Shortening and Oil Division of the National Cottonseed Products Association, were as follows:

Shortening

	Per lb.
North and Northeast:	
Carlots, 26,000 lbs.	@10
3,500 lbs. and up	@10¼
Less than 3,500 lbs.	@10¾
Southeast:	
3,500 lbs.	@ 9¾
Less than 3,500 lbs.	@10¼
Southwest:	
Carlots, 26,000 lbs.	@ 9¾
10,000 lbs. and up	@ 9¾
Less than 10,000 lbs.	@10¼

Salad Oil

North and Northeast:	
Carlots, 26,000 lbs.	@10
5 bbls. and up	@10¼
1 to 4 bbls.	@10¾
South:	
Carlots, 26,000 lbs.	@ 9¾
Less than carlots	@10

Cooking Oil—White

⅛c per lb. less than salad oil.

Cooking Oil—Yellow

¼c per lb. less than salad oil.

French linseed oil prices have dropped continually since the first of last year. In 1929 linseed oil was quoted at 380 francs per 100 kilos, rising for a time to 555 francs. In comparison with these prices quotations for oil at the end of November, 1930 were 345 francs per 100 kilos. The principal cause to which the downward movement is attributed is the fact that it is almost impossible for French manufacturers to operate on a profitable basis on account of the keen competition of Belgium, which country is the main supplier of linseed oil to France.

Solvent Extraction Successfully Applied

*Extraction Practical and Economical for Vegetable Oils and Press Cake Under Controlled Conditions**

By CLARENCE F. EDDY†

THE modern trend is clearly away from numerous small oil mills to a smaller number of larger and more efficient mills. In the movement for economy through better efficiency, the greater yield of oil obtainable by solvent extraction cannot be ignored indefinitely. Despite the fact that this method has been used so extensively and successfully in Europe, its use has not spread rapidly in this country. It will bring the subject much nearer home to discuss the experiences of a domestic corporation which for several years has extracted vegetable oils by solvents.

This Corporation started with standard hydraulic equipment and later on began the operation of a branch plant using solvent extraction. In slightly over a year, the original pressing plant had been abandoned but the solvent extraction plant has been enlarged and operated steadily. During nearly eight years, oil has been extracted from five varieties of seeds and one variety of press cake, using two different kinds of batch extractor and one kind of continuous extractor. Perhaps the most significant point is that for several years operations were confined to press cake. During that time the Corporation made its profits solely by extracting such oil as hydraulic presses had failed to remove. Steady progress has been made although the experience has been more expensive in money and hard work than would have been the case had more information been available. It is with the hope of aiding the cause of solvent extraction by helping others to avoid certain preventable difficulties that this discussion is presented.

* *Presented at Fourth Annual Fall Meeting of The American Oil Chemists' Society, Chicago,* Nov. 13, 1930.
† Chief Chemist, Prosco Oils Corporation.

Design of Plant

FIRST, do not expect any given layout to be equally efficient or equally economical for all materials. Modern extraction systems must keep in step with modern conditions. The old concept of economy of space and apparatus that led to combining as many functions as possible in one piece of apparatus is yielding to specialization of function in the larger scale installations. Also there is the fact that while it may be both scientifically and economically feasible for a small operator to have his system so flexible as to handle a large variety of raw materials, the larger scale operator who makes such an installation is treading on dangerous ground economically. For example, take a plant designed to extract both 65% copra and some presscake with only 8% of oil. The distillation equipment and the apparatus for removing solvent from the meal and handling, grinding and bagging it are designed accordingly. While operating on copra, the distillation equipment is running to capacity but all the apparatus for the meal is up to but roughly one-third of capacity. While operating on presscake only about one-fifth or less of the distillation capacity is utilized while the meal handling apparatus is busy. No matter which raw material is used, either operation must carry the overhead of a lot of excess capacity. Obviously this would not be true of a plant designed for only one, or only for similar raw materials.

Any good system must have some flexibility but to be prepared to handle a large variety of raw materials is expensive. Not only will the requirements of capacity vary for the several units but there may be a necessary change in some unit when turning from one raw material to another. For

example, it might be necessary to use different crushing equipment. Changes of procedure, like going from hot to cold extraction, would not necessitate any change in equipment but there are many possible changes which would require new apparatus.

The manufacturer of vegetable oils on a large scale must operate on a narrow margin and so cannot afford to overlook small differences of yield, steam consumption and cost of solvent which quickly mount up to sizable items in a large plant. Therefore, in changing raw materials, he must expect to have to make some changes in equipment, procedure, or both if the most economical results are to be obtained.

Controlling Factors

BEFORE considering any special system of extraction, certain questions should be answered.

A. Capacity
   1. What tonnage per day?
   2. How many hours in the working day?

B. Raw Material
   1. How many materials must this particular Installation handle?
   2. Name them.

C. Yield
   1. Which takes precedence, quantity or quality? For example a hot extraction might yield higher quantity but poorer quality.
   2. Which takes precedence, cost of extraction or specification of residue? For example if it proves cheaper to leave 1.5% oil in the residue than to extract down to 1%, will you be satisfied or must the 1% specification be met?

D. Quality of Extract.
   1. Is the oil very sensitive to heat?
   2. Is color an important factor?
   3. Do you want to extract anything besides the oil? Example, Bollmann's process of using mixed solvents to extract both oil and lecithin from soya beans.

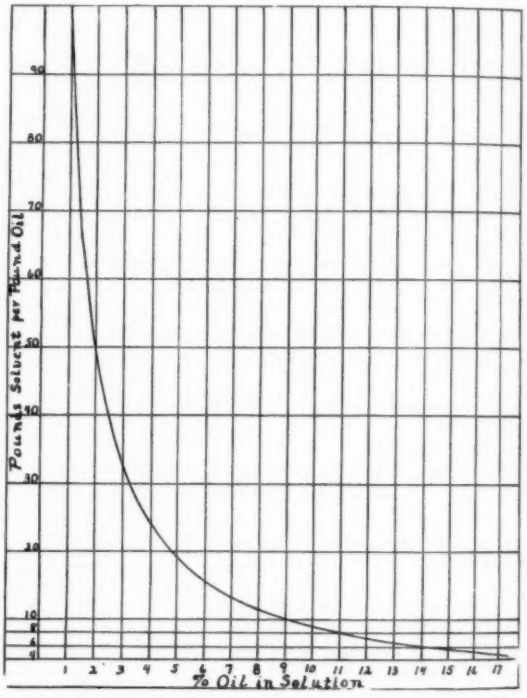
E. Quality of Residue.
   1. What use is contemplated? Fertilizer? Feed? Special use?
   2. What moisture specifications?

These questions sound extremely elementary but solvent extraction systems have been installed without either the buyer or seller having a clear idea of exactly what is expected of the installation. Instances where both parties have been indefinite on account of "trade secrets" have been known to cover mere ignorance.

Another preventable source of trouble and misunderstanding is the statement of percentages without specifying the bases. This frequently results in the comparison of percentages which are not on the same basis and so are not comparable. For illustration, take copra and extract 64 out of 65 lbs. of oil present in 100 lbs. and some presscake and extract 7 out of 8 lbs. present. The percentages of residual oil might then be expressed:—

	Copra	Presscake
1. Basis of raw material	1.00%	1.00%
2. " " total oil in raw mat.	1.54%	12.50%
3. " " the residual meal	2.78%	1.18%

The moisture content of the residue will vary so the safest way is to check extractor operations by percent of oil in the bone dry residue. Knowing the moisture and oil contents of the raw material used over a period, it is a simple matter to convert the average of the checks back to the basis of the original raw material and obtain a direct check on production.



Curve Showing Pounds Solvent per Pound Oil Plotted Against Percent Oil in Solution

Specific Systems

COMING now to the consideration of specific types of extraction systems, a hypothetical case will be considered which is a composite of various conditions actually demonstrated by laboratory determinations, plant practice or both. With this seed, certain determinations have been made.

Crushing: With standard crushing equipment it has been found that a small percentage of the raw material goes through not sufficiently ground to permit complete extraction. In other words, a sample from the crushing equipment cannot be completely extracted without further grinding. The laboratory analysis shows 45.2% oil extractable from the sample as received and 45.5% total after further grinding. Basis raw material there is therefore 0.3% oil unavailable for extraction. To crush finer in the plant would increase crushing costs out of proportion to the increased yield, complicate the operation of the extractors, and injure the quality of the oil. That much residual oil is therefore part of the calculations but the extractor operations must not be held accountable for that portion of the oil in the residue.

Extraction: It has been demonstrated that, given proper agitation, early in the extraction, all the *available* oil is in solution, but part of the solution is soaked up in the seed. Subsequent extraction merely dilutes the absorbed solution, the weight of solution retained being constant. In other words as more oil is removed, more solvent is retained. (The percent of solution retained varies with the material, state of subdivision, moisture content, and solvent used.)

At the completion of extraction when the solvent is distilled off, any oil in solution will be re-absorbed by the fiber. The oil in the residue may then be considered in two classes; first unavailable for extraction, and second, dissolved but not washed out and so re-absorbed when the solvent is driven off.

Now follow 100 lbs. of the raw material through the process:

1. Before Extraction: Here the weight of the component parts and the percentages are identical.

	lbs.	%
Moisture	5.5	5.5
Available Oil	45.2	45.2
Unavailable Oil	.3	.3
Fat and Moisture—free residue	49.0	49.0
	100.0 lbs.	100.0%

2. At the end of extraction but before the absorbed solvent has been driven off: During extraction most of the available oil has been removed, but the weights of the other components remain the same even though the percentages have changed, due to removal of oil and absorption of solvent.

	lbs.	%
Solvent	27.5	33.33
Moisture	5.5	6.67
Available Oil	.2	.24
Unavailable Oil	.3	.36
Fat and moisture—free residue	49.0	59.40
	82.5 lbs.	100.00%

Note:

A. The solvent and moisture together, the total volatile matter, constitute 40% of the wet residue.

B. The bone dry residue would weigh 49.5 lbs. of which 0.5 lb. is oil or 1.01%.

C. At the completion of extraction there was 0.2 lb. available oil in solution in 27.5 lbs. of solvent, which is a 0.72% solution.

Therefore under these conditions, in order to obtain a residue analyzing 1.01% on the dry basis, extraction must be continued until the final solutions test only 0.72% oil. If, then, the extraction system is one of those which in final analysis are glorified Soxhlet extractors where all solutions are distilled, the picture on distillation would be as follows:

% Oil in Solution	Lbs. solvent distilled per lb. oil
20%	4.0 lbs.
15%	5.7 "
10%	9.0 "
5%	19.0 "
4%	24.0 "
3%	32.3 "
2%	49.0 "
1%	99.0 "
0.72%	138.1 "

For efficient and economical large scale production, the following are suggested:

1. *Extraction Efficiency*: The simplest apparatus possible to wash out the maximum amount of oil with a minimum of solvent.
2. *Steam Consumption*:
   A. Removing solvent from oil. Distill only the most concentrated solutions feasibly obtainable.
   B. Removing solvent from meal. Use apparatus specially designed for that purpose and used continuously so as to avoid steam loss in heating the apparatus periodically.
3. *Solvent Loss*: A tight system, good recovery apparatus and a minimum solvent turnover.
4. *Labor*: A system requiring a minimum of changes such as opening valves, shifting solutions, etc.
5. *Control*: Use of mechanical control of flow of solids and liquids, eliminating human element where possible, but yet subject to adjustment.

Summary

EXTRACTION efficiency clearly points to counter-current extraction and with the other requirements indicates continuous operation. So our investigations and plant experience together with consideration of modern production methods have led us to the firm conclusion that the future of large scale solvent extraction of vegetable oils lies in continuous counter-current extraction.

Corn Oil Preparation and Usefulness

*A Historical and Descriptive Sketch Outlining the Growth and Development of the Corn Oil Industry**

By G. A. MOORE†

FIFTY years ago there were a number of plants grinding corn or maize for the production of starch, but the whole kernel went to the burr mills for grinding, the embryo or germ separating from the starch with the hull or fibre and the gluten after grinding. The latter constituted the cattle feeds the same as today, but considerable difficulty was encountered in the feed dryers due to the gummy material which formed on the inside from the oxidation of the oil. We are indebted to Dr. Behr of the old Chicago Starch Plant for the invention of our present system of separating the germ from the rest of the kernel. Dr. Behr was the second man to receive the Perkins Medal and these germ separators constituted one of the reasons for the award. He built the first separator at the Chicago Plant and they are built in the same form today. They were the biggest forward step in the starch industry up to that time. It remained however, for Thomas Gaunt to make the first plant installation at the Peoria Starch Plant, then operated by the Hamilton Brothers. Shortly after this all corn grinding plants installed germ separators, and the separation and pressing of the germ for oil had come to stay.

Corn Grinding Processes

THE first step in the grinding of corn is the cleaning of the shelled corn to remove all traces of cob, dust or any other foreign material. The cleansed kernels then go to large cylindrical vessels, called steeps, where they are allowed to soak or steep for thirty or forty hours in warm water slightly acidified with sulfurous acid. During this time the grain is softened and separation into its different parts is easily accomplished. The softened corn then is ground in attrition mills in which the kernel is cracked or torn to pieces without injury to the germ. From the attrition mills the cracked corn is passed through the germ separators. These are long deep troughs narrower at the bottom than at the top, having a weir at one end. They are kept full and constantly overflowing with starch milk of about 7° to 8° B. They are also equipped with spiral agitators on the bottoms and slow moving rakes on the top surfaces. The bulk of the grain settles to the bottom but the germ, owing to its oil content, floats and is carried by the rake to the end where it flows over the weir with the starch milk. The heavy particles which sink to the bottom are removed for further treatment, but we are concerned only with the germs. These, flowing from the separators, are strained from the starch milk and washed with water to free them from adhering particles of starch and gluten by passing them through revolving sieves called reels. They then are pressed in squeezers to remove as much water as possible before drying in large steam heated rotary dryers. The germs contain about 50% of oil which is about 3.5% on the corn. Originally this oil was extracted by hydraulic presses after the germs had been further prepared by being crushed between corrugated rolls, dampened and heated by vessels called germ cookers. The hydraulic presses produced a first class crude oil, but from 14% to 16% of oil was left in the cake.

Oil Expelling

LOUIS BAUER was the first to try the Anderson expeller for extracting oil from germ, but without much success. G. A. Chamberlain, late of the Staley Company at Decatur, had much faith in the expellers and for experimental purposes installed some at the Granite City Starch Plant. The expellers were there when Jefferies was made superintendent of the plant. Through his efforts,

* *Presented before the Fourth Annual Fall Meeting of American Oil Chemists' Society, Chicago, November 14, 1930.*

† Corn Products Refining Company.

about 1910-11 they were made to operate satisfactorily and the hydraulic presses were removed from the plant. Today the expeller has replaced all presses, increasing the yield of crude oil and producing a cake with an oil content as low as 7%.

The oil from the expellers is filter-pressed to remove all fine particles of germ or fibre and then allowed to cool and settle in large storage tanks from which the clear oil is drawn off and sent to the refinery. The quality of the crude oil, is as a rule, very satisfactory in regard to free fatty acid, but varies somewhat, depending upon the quality of the corn. Occasionally when the corn crop has been of poor quality, the free fatty acids in the crude will exceed 3% to 4%. I can recall one year when the average free fatty acid was around 9% and I have refined oil having a free acid content as high as 21%. While the principle of the recovery of the oil is simple, the technical steps have to be carefully supervised, as careless operation of the germ dryers and the expellers will result in an oil having not only an increased free fatty acid content, but also a color which is practically impossible to remove.

Refining Treatments

A GOOD crude corn oil readily responds to the refining treatment and produces a highly nutritious and palatable oil, excelled by none. The free fatty acids, albuminous matter and most of the non-glyceride compounds of fatty acids are removed by treatment with caustic soda liquor. All traces of soap resulting from the alkali treatment are removed by a special process, and the odor and foreign flavor by deodorizing with live steam under high vacuum. Corn oil can be used in all places where a high grade oil or fat is used. It is an excellent shortening and is used in the making of all forms of salad dressings. In the making of mayonnaise, it is easily emulsified and the emulsion is stable. Many mayonnaise makers lay their failures to the oil when it is often the other ingredients, particularly the eggs, that are at fault. A poorly refined or rancid oil will emulsify and produce a good-bodied dressing though of unsatisfactory flavor. Many mayonnaise manufacturers prefer corn oil, especially in the winter months, because of the low solidifying point. Oils of higher solidifying point tend to crystallize on chilling, the crystals piercing the egg coating of the oil particles, causing an oil separation when the dressing is again brought to the average room temperature.

Corn oil is an ideal material for the making of pie crust and the baking of cakes. It is used in the popping of corn, either by popping the corn in heated oil or coating the popcorn after popping in electric heaters. In this case it is much preferable to butter. Corn oil is an excellent medium for deep frying of doughnuts, fritters, potatoes and adds a delicate flavor to fish. In any recipe specifying lard, butter or lard compounds, corn oil can be used with equally as good and often more satisfactory results.

There is one point I want to mention particularly. Many large users of corn oil specify, it must be negative to the Kreis test for rancidity. Undoubtedly all refined corn oil when fresh is negative to the Kreis test, but care must be used in the method of applying the test. Often corn oil when shaken in a test tube with concentrated hydrochloric acid will give a pink color in the acid layer. If phloroglucin solution is then added the pink color remains for a short time leading to erroneous conclusions. On standing, however, the pink color disappears which is not the case with a positive test. There has been much controversy on the reliability of the Kreis test and in view of the above it is easily seen how one can misjudge. As a matter of fact, we put more faith in the haemoglobin test for incipient rancidity than we do in the Kreis test, as it will show a slight color on an oil at what might be called the turning point though still negative to the Kreis test and a strong color on an oil positive to the Kreis test.

I want to thank Mr. F. L. Jefferies and Dr. Otto Sjostrom for many of the points in the early history of corn oil production.

Golfers Prepare ! !

The Golf Committee for the Annual Convention of The American Oil Chemists' Society, consisting of N. C. Hamner, *Chairman*, J. J. Vollertsen and H. P. Trevithick, undaunted by snow on the greens, is already hard at work paving the way for an interesting tournament to be held at New Orleans in May, 1931. The Committee have received many entries for the tournament already and urge all members to send in their entries, accompanied by their handicaps (reasonable handicaps are preferred, and all others will be subject to censorship), at the earliest possible date. Several of the companies who supply apparatus and materials to the oil industries have already signified their intention of donating prizes for the tournament, and Chairman Hamner states that the prizes will be well worth the golfers' best efforts.

Shortening and Oil Production in 1929

Bureau of Census Publishes Figures Showing Slight Decrease in Quantity and Increase in Value for Year

LARD substitutes and vegetable cooking oils produced in the United States in 1929 were totaled 1,691,016,640 pounds, with a value of $192,031,895, according to the census of manufactures taken by the Census Bureau, Washington. This was a decrease of 3.3 percent in quantity and an increase of less than one-tenth of one percent in value as compared with 1927, the last previous census year, when the output totaled 1,748,475,056 pounds, valued at $192,029,802. Of the total for 1929, 1,206,163,486 pounds of lard substitutes and vegetable cooking oils, valued at $135,987,912, were reported by establishments in the industry (those engaged primarily in the manufacture of lard substitutes and cooking oils) and 484,853,154 pounds, valued at $56,043,983, were made as secondary products by establishments engaged primarily in other lines of manufacture, principally meat packing.

There were 38 establishments reporting in 1929 against 33 in 1927, employing 2,462 wage earners in 1929, and 2,655 in 1927. Wages paid in 1929 totaled $2,627,929, against $2,624,371 in 1927. Materials, containers, fuel and electric power cost $131,935,892 in 1929 and $137,078,600 in 1927.

The following table contains comparative figures for 1927 and 1929 of the production by kind, quantity and value:—

	1929	1927	Percent increase or decrease
Lard substitutes and vegetable cooking oils made in all industries—			
Aggregate pounds	1,691,016,640	1,748,475,056	—3.3
Aggregate value	$192,031,895	$192,029,802	*
Made in the "Lard substitutes and vegetable cooking oils" industry—			
Total pounds	1,206,163,486	1,243,231,269	—3.0
Total value	$135,987,912	$134,881,074	0.8
Made as secondary products in other industries—			
Total pounds	484,853,154	505,243,787	—4.0
Total value	$56,043,983	$57,148,728	—1.9
Lard substitutes—			
Total pounds	1,268,795,802	1,239,087,167	2.4
Total value	$148,775,974	$142,576,674	4.3
Made in lard-substitutes and cooking-oils industry—			
Total pounds	822,268,540	775,006,564	5.1
Total value	$97,163,744	$89,319,769	8.8
From vegetable oils and fats, solely—			
Package goods, 8 pounds and under—			
Pounds	212,629,144	205,144,129	3.6
Value	$27,699,945	$26,018,953	6.5
Other, over 8 pounds—			
Pounds	435,756,304	332,193,741	31.2
Value	$49,290,042	$35,837,600	37.5
From animal fats and vegetable oils—			
Package goods, 8 pounds and under—			
Pounds	70,839,706	80,580,401	—12.1
Value	$8,761,612	$10,158,869	—13.8
Other, over 8 pounds—			
Pounds	103,043,386	157,088,293	—34.4
Value	$11,412,145	$17,304,347	—34.1
Made as secondary products in the meat-packing industry†—			
Pounds	428,843,029	438,036,959	—2.1
Value	$49,493,248	$50,331,378	—1.7
Made as secondary products in other industries†—			
Pounds	17,684,233	26,043,634	—32.1
Value	$2,118,982	$2,925,527	—27.6
Vegetable cooking oils—			
Pounds	422,220,838	509,387,889	—17.1
Value	$43,255,921	$49,453,128	—12.5
Made in lard-substitutes and cooking-oils industry—			
Pounds	383,894,946	468,224,705	—18.0
Value	$38,824,168	$45,561,305	—14.8
Made as secondary products in other industries—			
Pounds	38,325,892	41,163,184	—6.9
Value	$4,431,753	$3,891,823	13.9

* Less than one-tenth of 1 percent.
† Not reported as to materials used or as to size of container.

Orthodichlorbenzene An Ideal Fat Solvent

Non-corrosive Qualities, Non-inflammability and High Volatility with Steam Among Advantages Listed

By J. EHRLICH

MANY fat and oil technologists in recent years have been converted to the method of isolating fatty substances by means of an organic solvent. The chief advantages, as against the cold or hot pressing processes, are low initial investment and practically quantitative isolation of the original fat from the cake or meal. The most efficient pressing methods will leave 3-10 percent fat in the cake, depending on the material pressed, whereas a solvent process, when properly conducted, will leave a maximum of ½ percent.

The "orthodichlorbenzene" of commerce has many outstanding properties as a fat solvent. A typical commercial quality contains approximately 75 percent orthodichlorbenzene and 25 percent of the para isomer. Traces of trichlorbenzene may be present. The solvent is available in large quantities at a reasonable price as a byproduct of the manufacture of paradichlorbenzene. The material is a clear, practically white, limpid liquid. It shows only a slight solidification at 7° C, and must be cooled appreciably below this point to assume a pasty consistency. The boiling range is approximately 160-200° C. The specific gravity will vary slightly, a type sample being 1.309 at 25/25° C.

Orthodichlorbenzene is volatile and has a penetrating but not unpleasant camphoraceous odor. Bulletin 167 of the U. S. Department of Agriculture shows that paradichlorbenzene vapor is harmless to human beings under ordinary conditions. Orthodichlorbenzene may be expected to show analogous pharmacological properties. It may, nevertheless, be stored under water, with which it is immiscible. The fire hazard is conspicuous by its absence. A free flame may be played with impunity over the surface of the solvent until the flash point (about 67° C) is reached. But even above this temperature the material will not continue to burn if the flame is removed. This compares very favorably with the chlorinated aliphatic hydrocarbons in general use, and like them has the advantage of non-flammability over solvents of the benzol or gasoline type.

Non-corrosive Properties

BUT a quite common difficulty encountered in oil solvent processes employing chlorinated alipahtic hydrocarbons is the formation of muriatic acid due to the hydrolysis of these chlorine compounds by moisture in the fatty material being extracted. This necessitates thorough preliminary drying of the fatty material and also requires expensive acid-resisting installations. On the other hand, orthodichlorbenzene is characterized by its extreme stability towards water under the most drastic conditions.

In one experiment made at the Verona Chemical Co. to show the inertness of orthodichlorbenzene towards water, a mixture of these materials in vapor form was passed during several hours, through a heated steel tube so that the inside temperature reached 180° C. The exit gases on condensing gave unchanged orthodichlorbenzene and water. The latter showed no trace of muriatic acid present. The inner surface of the steel tube remained bright and uncorroded. In another experiment orthodichlorbenzene was boiled with water in a steel vessel for 48 hours under reflux condenser. Here likewise no sign of corrosion was evident, and no muriatic acid was formed. Obviously then, steel construction can safely be used throughout for solvent plant employing

orthodichlorbenzene, and the necessity for preliminary drying of fatty material is eliminated. Moreover, orthodichlorbenzene displays a great avidity for fats, and extracts them completely even from substances containing an appreciable amount of free water.

Because of the relatively high boiling point, it is impractical to recover the solvent by heating with indirect steam. This presents no difficulty, since orthodichlorbenzene is volatile with only 1.5 times its weight of direct steam at atmospheric pressure. Due to this extreme volatility with steam, the recovery of the solvent then becomes a simple direct steam distillation to remove it quantitatively from the dissolved fat content. The vapors from the steam still are readily condensed, and then separate quickly and sharply into a lower layer of orthodichlorbenzene (ready for re-use) and an upper one of water, in which the solvent is insoluble. The loss of solvent is negligible.

A new lot of orthodichlorbenzene when purchased may show a small amount of material not volatile with direct steam. On these batches a preliminary steam distillation is required before using in the solvent plant, in order to obviate any danger of contaminating the fat.

The use of orthodichlorbenzene as a fat extraction medium was described and patented several years ago[1]. There has been a recent application of this process to the quantitative assay of fat bearing materials[2].

VERONA CHEMICAL CO.,
Newark, N. J.

[1] J. Ehrlich to Verona Chemical Co., U. S. Patent 1,610,270 of Dec. 14, 1926.

[2] C. P. Harris—This Journal 7 343-4 (1930). Robert Schwarz —This Journal 7 335-6, 347 (1930).

Soap Analysis Report

DUE to unforeseen delays in organization of the Soap Analysis Committee, it was not possible to finish any work in time to present more than a progress report at the Fall Meeting of the American Oil Chemists' Society in Chicago. Plans, however, have been formulated to study the following determinations in soap analysis: unsaponifiable, unsaponified, total fatty acids, total fatty anhydrides, and true soap. Present official methods as outlined some years ago by the joint committee for the American Chemical Society and the American Oil Chemists' Society provide for the use of ethyl ether in these determinations. This solvent introduces difficulties due, first, to the formation of emulsions, second, to its power of dissolving traces of soap, and third, to the fact that, apparently, water solutions of soap hydrolize and yield fatty acids, introducing another error in the analysis and its necessary correction.

Two samples, one a practically pure tallow soap powder, and the other the same soap containing rosin, were prepared by drying and grinding by Mr. Peterson and mailed to the members. On these samples, the members were asked to determine the unsaponifiable and the unsaponified by the official method, correcting for soap in the final residue, and also for fatty acids by titrating in the cold with alcohol, phenolphthalein and caustic. The same tests were then to be made, according to the FAC method for unsaponifiable using petroleum ether, and making the same corrections if necessary. Of course in determining the unsaponified, it was only necessary to dissolve 5 grams of the soap in 50% alcohol and extract with petroleum ether. However, after these had been extracted with petroleum ether, the soap solutions were boiled to free from alcohol, dissolved in water and re-extracted with ethyl ether as in the preceding method making the same corrections as before.

Due to unforeseen delays, as explained above, we have not yet finished this work. Mr. Sheely and Mr. Church have submitted complete reports as well as the Chairman. The others we hope to receive soon. However, the following general conclusions seem to be indicated already: the difference in the results obtained by the two solvents (after proper corrections are applied) seem immaterial: there is no comparison between the speed and ease of handling the tests, as the petroleum results can be obtained complete in a short time, while due to the emulsions formed, the necessity of making corrections, etc., the ethyl ether method takes several days: further, due to the fact that the soap is dissolved in water for ethyl ether extractions hydrolysis is caused to such an extent that the extractions with ethyl ether gave large residues of extractable matter, which, however, were practically all fatty acids. Of course, we can not render a complete report until all the other collaborators finish their work.

We also propose to study the total fatty acids determinations, the determination of fatty anhydrides, and the measurement of true soap as sometimes the results obtained by calculations from the total fatty acids do not check the results obtained by determining the soap by titration of the acids with caustic and weighing the soap. If any member of the Society or anyone else, has any suggestions along these or other lines for the soap committee to work out, we would be very glad to receive them.

H. P. TREVITHICK, *Chairman*

Glycerin Analysis Report

The following report of the Glycerin Analysis Committee of The American Oil Chemists' Society was presentel at the Fourth Annual Fall Meeting at Chicago, November 13.

THE report of the Soap Section at New Orleans last May directed attention to the fact that the accepted analysis of the A.O.C.S. Standard Crude Glycerin accounts for only about 98.5% with 1.5% unaccounted for. The analyses used to make up this total were those for true glycerol content by the acetin method, organic residue, ash and moisture. This discrepancy was confirmed in the laboratory of Mr. A. K. Church by an analysis on a sample of Standard C. P. Glycerin certified to by the British Executive Committee in which the acetin result was about 1.5% lower than the apparent glycerin content by the specific gravity or bichromate method. In view of the excellent agreement between cooperative analyses by the acetin method, these discrepancies are very disturbing.

While the problem is chiefly of an academic nature, a letter of inquiry sent out by your chairman evoked a surprisingly large number of replies indicating not only a keen interest but a willingness to work. It was felt that any further cooperative work should take the form of analyses by the bichromate, acetin and specific gravity methods on several commercial distilled glycerins of C.P. or U.S.P. grade and, if possible, on a few highly purified glycerols. A number of laboratories have volunteered to determine moisture on these cooperative samples but, as was expected, few care to undertake the task of preparing a highly purified glycerol. One such attempt has been made, however, and a set of four samples is ready for distribution to fourteen laboratories which have agreed to work along the lines outlined above. We are also in correspondence with the British Executive Committee, from whom we hope to obtain sufficient Standard C. P. Glycerin for our use as a cooperative sample to be distributed later. The committee will be very grateful for any suggestions or advice which will aid in the solution of the problem before us.

J. T. R. ANDREWS, *Chairman.*

The stockholders of the Will & Baumer Candle Company, Syracuse, have voted approval to an increase in the company's authorized common stock 150,000 shares from 100,000 shares. It was stated that it has no intention to issue the additional shares now.

New Books

HYDROGENATION OF ORGANIC SUBSTANCES: By Carleton Ellis, 8vo, 1014 pp. New York, D. Van Nostrand Co., Inc., $15.00.

CARLETON ELLIS, whose previous work on the hydrogenation of oils has been for many years the standard reference book on the subject, has now completed the preparation of this new and enlarged edition which carries the subject into the fields of general organic chemicals and fuels, including coal and petroleum oils, while at the same time recording all the advances in the hydrogenation of fatty oils since the publication of the original volume. The method of treating the subject is all-inclusive, every process and type of equipment, as well as every patent and every published investigation being recorded.

The study of the subject of hydrogenation is developed in the text in a logical, progressive manner. Preliminary consideration is given to the theory and mechanism of catalysis, catalytic poisons, and the many varieties of catalysts, metallic and non-metallic, that have been proposed. The general applications of hydrogenation in organic chemistry, with particular reference to hydrogenation of carbocylic compounds, are next considered. Nuclear hydrogenations and those at nitrogen linkages are discussed fully, followed by a thorough and complete discussion of the hydrogenation of fatty oils, including a resumé of the developed uses for hydrogenated oils and fats, edible and technical.

The reader is led progressively through the hydrogenation of naphthalene, anthracene, phenanthrene and their derivatives to the hydrogenation of coals and related hydrocarbons and that of mineral oils. The reduction of carbon monoxide by hydrogenation methods and the synthesis of methanol are carefully reported and the final chapters of the book describe the various practical methods for the generation of hydrogen.

This is truly a monumental work, and all chemists who have any interest whatever in organic synthesis or in fatty oils, or in fuels of any kind, will want to include it in their libraries.

All producers and manufacturers of oils, soaps and allied products will also find Ellis' volume of incalculable value.

Determination of Total Fatty Acids

*Method for Soap Using Modified Stokes Flask**

By A. K. CHURCH†

THIS method is novel in that a specially designed extraction flask, a modified Stokes flask, suggested by members of our laboratory staff, is employed in extracting the fatty acids in place of the usual separatory funnel, thereby materially reducing the time required. When ether is mentioned ethyl ether is meant, unless otherwise specifically stated. When a Stokes flask is mentioned the specially designed modified Stokes flask is indicated. Prepare the sample in an acceptable manner—for example, by the A.C.S. standard method.

Separation of the Fatty Matter Containing the Fatty Acids

FIVE grams of the sample are weighed on the analytical balance, using an aluminum pan counterpoised with a brass weight except in the case of liquid soaps when approximately 5 grams are weighed from a weighing bottle. Transfer to a 100 cc beaker. Soaps containing perfume, or other volatile matter soluble in ether, must be dried overnight in a 105° C oven to drive off all such volatile matter before dissolving the soap in water.

Now dissolve in about 20 cc hot water and wash into the special Stokes extraction flask with a little hot water. Powdered soaps may be washed directly into the flask through a small funnel with about 50 cc cold water. 1 C additional water is added to bring the total volume of water in the extraction flask to about 75 cc. The flask is now placed on an asbestos mat on a hot plate and heated until complete solution (or disintegration) of the soap takes place when 10 cc 1 : 1 hydrochloric acid is added to precipitate the fatty matter. Three glass beads are dropped into the flask, an air condenser (30″ long) attached, and the contents allowed to boil gently on an asbestos mat on the hot plate until the fatty matter forms a clear layer.

Extraction of the Fatty Matter Containing the Fatty Acids

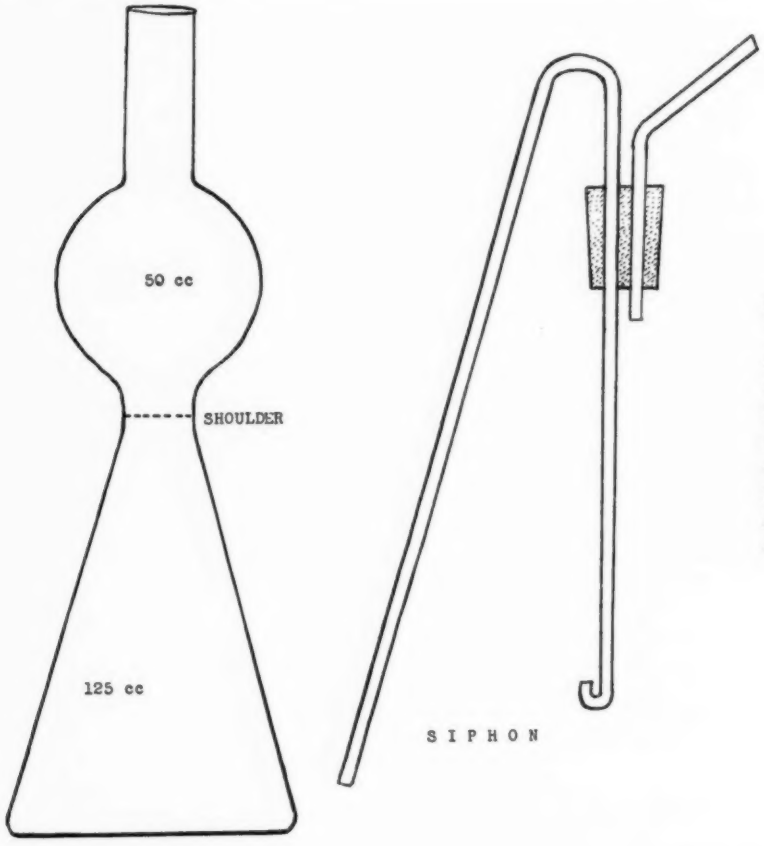
COOL the flask by placing it in cold water, wash the condenser down with a little ether, remove the condenser and rinse it with ether. The amount of ether for these operations need not exceed 30 cc. The contents of the flask are well mixed to insure complete solution of the fatty matter in the ether. A 10% solution of sodium chloride (saturated with ether) is now added until the junction of the ether and water layers is just above the shoulder of the lower part of the flask. Insert the siphon in the flask so that the turned up end of the tube projects about ⅛″ above the surface of the water layer. Place the forefinger of one hand over the end of the short tube and hold the upper part of the flask with the other hand. This will cause the ether vapor to expand, and the ether solution of the fatty matter will siphon off into the weighed 150 cc flask. Add 10 cc ether to the extraction flask, shake gently and again siphon off the top layer. Now remove the siphon tube, add 15 cc ether, insert a wet rubber stopper in the extraction flask and invert the whole three or four times. Violent shaking is unnecessary. Allow the ether layer to separate, siphon off and repeat the extraction twice, each time using 15 cc ether. The total volume in the weighed flask will not exceed 90 cc of ether.

Evaporation of the Ether

PLACE the weighed flask containing the ether extract on a water bath and evaporate the ether, controlling the bath so that an excess of water vapor does not fill the hood,

* *Presented at Fall Meeting American Oil Chemists' Society, Chicago, November 13.*

† Chief Chemist, Lever Brothers Co.



THE Modified Stokes Flask is eight inches high over all. It is three inches in diameter at the bottom and two inches in diameter at the widest point of the bulb above the shoulder. Below the shoulder, it has a capacity of 125 cc. and above the shoulder a capacity of 50 cc.

thus guarding against condensed water vapor getting into the flask. The last traces of ether vapor are blown out of the flask with a slow current of air and, if the manipulation has been carefully carried out, there should be no visible water in the bottom of the flask. When there is visible water present, the fatty matter cannot be weighed directly but may be weighed as a sodium soap.

Weighing Fatty Matter Directly

THE weighed flask containing the fatty matter is now heated in the 105°C air oven for just five minutes, no longer, cooled in a desiccator and weighed. Dry in 105°C oven for an additional 5 minutes to obtain check weight. The total fatty matter includes in addition to the fatty acids any unsaponifiable oil, neutral fat or other ether soluble matter present which must be determined and deducted to obtain the fatty acids. The percent of fatty acids times .97 gives the fatty anhydrides nearly enough.

Total Soap and Combined Alkali

AFTER evaporating off the ether as directed above, add 100 cc of neutralized alcohol free from carbon dioxide, add phenolphthalein indicator, and titrate to exact neutrality with standard semi-normal sodium hydroxide solution. Evaporate off the alcohol and water and dry at a temperature not exceeding 105°C to constant weight. At this stage the soap includes any unsaponifiable oil and neutral fat present, as well as the neutral salts from the sodium hydroxide and alcohol, all of which are determined separately and deducted from the total weight to obtain the true soap. Calculate the combined sodium oxide (Na_2O) and deduct from the weight of the true soap to obtain the fatty anhydrides. If the original soap is found to be wholly or partly potash soap, proper calculation must be made to reduce to potassium oxide (K_2O), or a mixture of K_2O and Na_2O, as the case requires. In case of the presence of free fatty or rosin acids in the soap, there must be determined and a proper correction made. If the soap contains rosin, determine the rosin

acids and substract the anhydrous rosin soap from the total anhydrous soap to obtain the soap from the fatty acids.

Unsaponifiable Matter and Neutral Fat

Results checking with the A.C.S. method are secured employing the Stokes flask and dissolving the soap in 50% alcohol and extracting with petroleum ether.

Rosin—Wolff's Method

THIS is the standard A.C.S. method except that the Stokes flash is used and a blank of .25 cc N/1 NaOH for each 3 grams of total fatty and rosin acids is subtracted from the titration. This blank was arrived at by running a test on pure soap known to contain no rosin. Dissolve enough of the soap sample to give close to 3 g of fatty and rosin acids in about 100 cc of hot water in the Stokes flask, add a slight excess of dilute sulphuric acid (1:4), heat until the fatty and rosin acids collect in a clear layer, cool to room temperature and extract with ether, following the procedure given under "The extraction of fatty matter." Siphon the ether layer into another Stokes flask. Evaporate off the ether and dry the fatty and rosin acids one hour at 105°C, cool and dissolve in 20 cc absolute alcohol. Then add 10 cc of a solution of one volume of concentrated sulphuric acid (Sp. Gr. 1.84) and four volumes of absolute alcohol and boil on the steam bath for four minutes under a reflux condenser. Remove from steam bath, cool and add about 30 cc ether. A 7 to 10% sodium chloride solution (saturated with ether) is now added until the junction of the ether and water layer is just above the shoulder of the lower part of the flask. Extract the ether layer as in the extraction of fatty matter, putting the extract into a 150 cc flask. Add 30 cc neutral alcohol, and titrate the rosin acids with standard sodium hydroxide solution, using phenolphthalein as indicator. For 3 g of fatty and rosin acids subtract .25 cc from the total NaOH required and calculate to rosin or rosin soda soap as desired (1 cc normal alkali equals 0.346 g rosin or 0.377 g rosin soda soap).

When the constants of the fatty and rosin acids are to be obtained, the rosin may be determined by using 3 grams of the fatty matter prepared for this purpose.

IT is recommended that for soaps made from all, or largely, cocoanut oil the fatty matter be weighed as a sodium soap.

Some Results Obtained

Soap made from	% Fatty Anhydride weighing fatty acids directly and multiplying by .97	% Fatty Anhydride modified A. C. S. method using Stokes flask and weighing the soap.	% Fatty Anhydride std. A.C.S method using separatory funnels & weighing the soap.
100% Tallow	83.63	83.65	83.65
25% Coco, 75% Tallow	82.90	82.94	82.94
35% Rosin, 65% Tallow	67.41	67.39	67.43
100% Cocoanut Oil	73.82	74.15	74.16
20% Coco, 20% Corn, 60% Tallow	74.13	74.16	74.16

Olive Oil Tariff

The United States Tariff Commission has issued Notices, pursuant to Section 336 of the Tariff Act of 1930, that a public hearing in Investigation No. 25 will be held at the office of the United States Tariff Commission in Washington, D. C., at 10:00 o'clock a. m. on the 27th day of January, 1931, at which time and place all parties interested will be given opportunity to be present, and to be heard with regard to the differences in cost of production and all other facts and conditions enumerated in Section 336 Of the Tariff Act of 1930 with respect to OLIVE OIL.

Early reports from the whaling vessels in the Antarctic fields were very favorable, provided the supply of whales holds out, the yield of whale oil this year should be the largest on record and a probable increase of several hundred thousand barrels over last year. Most of the Norwegian companies as previously reported have already sold next season's yield at a price of £25 per ton for the 0/1 grade. Based on the capacity of the factories these sales represent a total production of 1,400,000 barrels of whale oil.

The International Situation in Oilseed Crushing

Summarizing Reports from Worldwide Sources to The International Conference of Oilseed Crushers

By FRANK MESSENGER*

PART III—Conclusion

Report from Holland

LINSEED which may be considered the most important raw material of the Dutch oil mills, during the past year proved how a slight shortage can cause a quick and upward movement in both the raw materials and the finished products. At times this showed quite a misproportion. It is obvious that the changed price level of the products works in a most disastrous way with regard to the complicated system of our crushing industry. However, at the same time and in the same intense way, it is reflected in the fat consuming industries, and on the feeding of livestock.

The sharp upward movement in the price of linseed which began at the end of June was reflected in a sharp rise in the price of linseed oil and linseed cake; both of which articles are of leading importance on the Dutch market. However, the upward movement in linseed was more sharp than that of the finished products. The result of these movements was that the profits of the crushers fell off sharply and eventually became a negative quantity. The first five months of 1929 was a favorable period. But the second half of the year started in exceptionally bad circumstances; which, for the seed crusher, who endeavors to do his purchasing and selling at the same time, resulted in considerable depression. The causes of this upward movement that started in June, with the later depressions in the market, may be summed up as follows: at the end of June information reached us from the Argentina that crops were short, and the exportable surplus of linseed was considerably less than had been anticipated. At the same time, we were informed of continuous drought, which would affect the 1929-30 growing season. These adverse crop reports, followed by news from the United States and from Canada that crop prospects were also less than had been anticipated, and the large imports of seed from the Argentina by the United States crushers, all tended to cause a wide speculation on the market. Our colleagues in America had the opportunity, owing to their home protection, of making a profit on linseed, while the free trade Dutch crusher could not possibly do so. During last year greater activity was noted in the crushing industry in Holland, and an increase of approximately 10 per cent. was registered, owing to greater imports of linseed. It is regretted that this increase has now ceased. During 1929 Holland crushed 14 per cent. linseed less than in 1928, which is attributed to the fact that c.i.f. prices of linseed increased from 360 Florins during the last of June, 1929, to the record price of 560 Florins in the third week of September. Crushers reduced their crushing capacity to a great extent to cope with the situation, but many of them who failed to have stocks in hand were compelled to purchase at high prices. The high price of seed caused linseed oil to move to a level higher than that of soya bean oil, or any of the other vegetable oils, with the result that many of the large consumers of linseed oil were banished from the market. The margarine industry had consumed large quantities of linseed oil during the first half of the year, as had also the soap industry. But as prices moved upward these two industries substituted other vegetable oils at a cheaper price. The only purchases of linseed oil were made by those industries which could find no substitutes for linseed oil.

The same situation was seen in the market for linseed cake. With the high price of linseed cake a substitute in the form of soya bean cake and meal was found, and inasmuch as an

* *U. S. Foreign Trade Commissioner at London. Widely-known Authority on World Trade in Oils and Oilseeds.*

exceptionally good crop was recorded in China there was an abundance of this material. The import surplus of cake increased from 18,000 tons in 1928 to nearly 49,000 tons in 1929. When the needs of the margarine and soap industries are considered it can be seen that the imports of soya bean oil were raised by 6,000 tons of oil, compared with 1928. From this it can be seen that shippers from East Asia profited in place of the Plate shippers. Another drawback to the Plate shippers was their harbor strike, which added confusion to the situation.

In addition to soya beans, peanuts also had a good share in the disparity caused by the high price of linseed oil. In 1929 there was an increase of 17,000 tons imported, compared with 1928, while the import surplus of peanut oil was decreased by approximately 5,000 tons. Other oleaginous raw materials also showed considerable change in tonnage, compared with the previous year. The shortage of Dutch made cakes in Holland was supplemented by increased importation from abroad. The net importation of cake for 1929 was 225,000 tons, against 203,000 tons in 1928. When it is considered that the Dutch crushers crushed a greater quantity of soya beans and peanuts it can be easily understood that the consumption of cake in Holland has greatly increased. The prices of soya bean, peanut and copra cakes were high, but not in comparison with the price of linseed cake. To complete the account, it is necessary to add that some of the mills also began the manufacture of the so-called mixed cakes or cubes. The price of these compound cakes is usually lower than that of pure cakes of the same feeding value.

Inasmuch as Holland has no Fertilizer and Feedingstuffs Act, it is difficult to induce the Dutch peasant to believe that these compound cubes are comparable with pure cake. It is believed, when normal conditions again return, linseed cake will again retain the prominent position that it has always held in the Dutch market.

By way of making a resumé of the situation it may be said that the Dutch oil manufacturers report the year of 1929 as unfavorable. The larger mills, as well as the smaller ones, look back on a difficult year, while the new year opened under unfavorable conditions. The difficulties that the Dutch exporters are finding in surmounting tariffs are becoming greater and greater, while the competition in the home market is becoming exceptionally keen. With regard to wages in Holland, there is very little change. At the end of 1928 a strike occurred in one of the important mills in the Zaan, which lasted two months, and ended at the beginning of 1929. After the strike the mill reopened without any change in wage conditions. The index cost of living is practically unchanged over the year, and remains at 167½, compared with 1913.

Report from Japan and Manchuria

JAPAN

Import of Oilseeds in Tons of 2240 lbs.

	1928	1929
Soya beans	460,961	558,676
Peanuts	11,537	14,787
Sesame Seed	20,678	19,621
Perilla	6,638	8,397
Rapeseed and/or Mustardseed	26,119	73,704
Linseed	16,904	15,655
Hempseed	12,742	17,672
Castorseed	13,459	12,004
Cottonseed	70,543	96,274
Others	—	50
Total	639,581	816,840

Import of Oils and Fats in Tons of 2240 lbs.

	1928	1929
Castor Oil	—	11
Cotton Oil	396	436
Wood Oil	522	609
Tallow	13,433	12,311
Hardened Oil	1,245	913
Total	15,596	14,280

Export of Oils and Fats in Tons of 2240 lbs.

	1928	1929
Linseed Oil	176	379
Coconut Oil	15	38
Bean Oil	4,813	6,578
Rape Oil	4,526	10,089
Cotton Oil	230	216
Fish Oil	35,622	34,522
Whale Oil	940	188
Hardened Fish Oil	5,137	5,523
Total	51,459	57,533

THIS time we have added the figures of import and export of oils and fats. The import of the raw materials in 1929, which mostly come from China, increased on account of the price having been reasonably low, due to the decline in silver, but the crushing industry had to suffer owing to only a low price being obtainable for cakes, which had to compete with an abundant supply of chemical manures. The cost of production remains about unchanged, although a trifle on the lower side.

The wages of the oil mill laborers are dearer at Y. 1.90 per day, against Y 1.87 in the previous year, which are 311 and 306, respectively, compared with 100 in year 1914. The index number of the cost of living records a fall to 174.8 from 179.8, against 100 in 1914.

MANCHURIA

Export from Manchuria
Year November-October (in tons of 2000 lbs.)
Soya Beans

	Total	To Europe	%
1927- 8—12 months	2,285,900	1,600,400	70.0
1928- 9—12 months	2,904,400	1,983,200	68.3
1928- 9—1st 6 months	1,634,400	1,056,600	64.6
1929-30—1st 6 months	1,315,100	767,200	58.3
Bean Oil			
1927- 8—12 months	109,901	61,353	55.8
1928- 9—12 months	98,678	49,185	49.8
1928- 9— 6 months	47,251	14,557	30.8
1929-30—1st 6 months	79,493	65,642	82.5

With the yearly increase in the production of soya beans, its export also rises every year. The year 1929 marks yet another fresh record in the export to Europe totaling nearly 2,000,000 tons, against 1,600,000 tons in 1928. Although the current season started very promisingly in this direction, there will be a marked decrease throughout the whole season, as the inevitable result of a much lower price.

The crushing industry in Manchuria, on the whole, experienced another difficult year, the result of which was reflected in curtailment of the production. There was 14 per cent. less production compared with the previous season. Exports of bean oil to Europe hardly amounted to 50,000 tons, which is the lowest recorded during the last ten years. There was, however, a sign of revival towards the end of the season, which has been maintained up to the current season. In consequence of a bad feedingstuffs market, there has been a great shrinkage of demand for soya beans to Europe, which has enabled the mills to cover their requirement for the raw material comparatively advantageously, and has placed them on a more or less remunerative basis. Consequently, bean oil is again finding its way into Europe, and there is every sign of a revival in this trade.

The trouble between the Soviets and China, which started in June, did not interfere with business transactions in a serious way, except just temporarily, but the result was the entire stoppage of transport to Vladivostok, while there was a corresponding increase in the transport of goods to Dairen by the South Manchurian Railway, which proved adequate enough to cope with the situation. A close study of the respective export figures of soya beans from Dairen and Vladivostack in 1929 and 1928 presents a striking contrast as regards the change brought about by this trouble between the two countries. The continuous decline in silver naturally made export business easier, but on the whole disorganized the trade in Manchuria to a great extent. There was not much change in the cost of production or in the wages of oil mill laborers. The Index number in Dairen shows a decline at 196.6 from 203.1 in the previous year, against 100 in the year of 1914.

From the above extracts it will be seen that Germany is the outstanding oilseed crushing country of Europe, owing principally to the increase in the crushing of soya beans. Linseed, which has long held the most important place among oilseeds, shows a gradual falling off. With regard to oils, the French oil industry is dominated by peanut oil, which has replaced olive and coconut oil to a considerable extent.

Plan for Chemical Show

Plans are already being made for the 13th Exposition of Chemical Industries which will be held at the Grand Central Palace, New York, during the week of May 4tht, 1931. The Exposition will again be run by the International Exposition Co., under the supervision of Charles F. Roth and F. W. Payne, with Dr. Arthur Little heading the advisory committee of twenty-two. Already three hundred exhibitors have reserved space for their displays. Plans are now being made for the Students Courses which will consist of three courses of two days each. The list of speakers is not yet complete.

Castor Oil Lubricants

Castor oil, neutralized with triethylamine, is replacing mineral oil as a lubricant for automobile and airplane motors in France, according to the Paris correspondent of the American Chemical Society.

The cultivation of castor oil plants has been increased in Morocco and Algeria in the last three or four years, with a view of getting national independence in lubricating oil. "The results obtained have been satisfactory, and castor oil is being used to an increasing extent to replace mineral oils, which, it is hoped by French officials, will be practically discarded for lubricating purposes as time goes on.

The acidity of castor oil has been one of its chief disadvantages as a lubricant. A method of neutralizing it with triethylamine has been devised by a woman chemist, Mlle. Francois. The triethylamine is a viscous liquid formed by mixing primary, secondary and tertiary amines, and it can be used to counteract the free acid in castor oil. The oil thus neutralized is washed with water, filtered, and dried, and, it is reported, has lost none of its lubricating properties and is indefinitely stable."

Notes of the Industry

Linseed Assoc. Meeting

The sixty-third annual dinner and business meeting of the Linseed Association of New York was held on the evening of December 11 at the Downtown Association. About 50 members and guests were present. Vice-President H. G. O. Dunham presided. E. J. Cornish, president of the National Lead Company, was the principal speaker. L. P. Nemzek, of E. I. duPont de Nemours & Co., also spoke. The retiring officers were re-elected. They are:—President, George W. Fortmeyer; vice-presidents, H. G. O. Dunham and F. A. Marsh; secretary-treasurer, T. J. Hastings.

Mr. Cornish read from a survey of flaxseed and linseed oil conditions, prepared by a close student of the situation, in which it was stated that in attempting to forecast the price trend of flaxseed and linseed oil it would be necessary to consider and analyze the following fundamental factors, which are now affecting or will influence prices in the first half of 1931:—Argentine, Indian, Canadian and domestic flaxseed crops; linseed oil cake and meal prices; international exchange value of the Argentine peso; price of silver; prices of competitive oils and fats in European countries; the wheat situation.

As to the Argentine crop it was estimated in this survey that the exportable surplus of that country will amount to about 85,000,000 bushels, or the largest on record. In referring to silver the survey points out that the purchasing power of the people of Asia, China, Mexico and several South American countries whose money system is based on the silver standard is vitally affected and the heavy decline in the value of silver is attributed to the unsettled political situation in China and the melting of India's silver money into bullion and the dumping of it on the world's market with the view of establishing the gold standard in India.

The Bureau of Customs has ruled that rapeseed meal may be imported free of duty as a fertilizer material as a result of examination of textbooks on stockfeeding and of interviews with feed dealers who agreed that, while rapeseed meal is an important stockfeed in Europe, it is never used for that purpose in this country.

Mayonnaise Survey

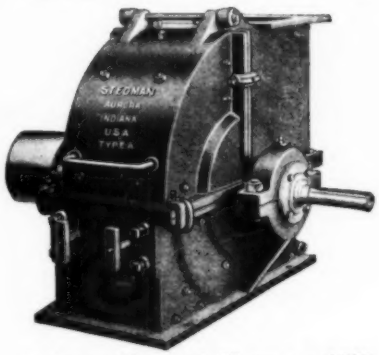
The Foodstuffs Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce, is conducting for 1930 the Annual Survey of the mayonnaise, salad dressing and related products industry. For the past two years, the Department of Commerce has collected, at the request of the Mayonnaise Manufacturers Association, figures on the production and distribution of mayonnaise and allied products. The interesting data developed by these surveys were presented at the conventions of the Association, were embodied in pamphlets by the Department, and were reported in various trade papers.

The Department is now undertaking a similar survey for 1930, and requests the cooperation of all manufacturers of mayonnaise and related products in filling out and returning at an early date the questionnaire which is being mailed to them by the Foodstuffs Division. The figures of each manufacturer will be held in strict confidence and will be included with those submitted by all concerns reporting in the compilation of the final report.

Production of lard in the United States in 1929 totaled 2,033,029,337 pounds, which were valued at $246,065,758, according to the census of manufacturers taken by the Census Bureau, Washington. This compared with a total production of 1,794,635,625 in 1927 the last previous census year, which had a value of $234,863,633. The 1929 production was an increase of 13.8 percent over 1927 and the value gained 4.8 percent.

Inquiries that have been made recently in Colombo, Ceylon, suggest the probability of the establishment of a factory for the production of whale oil. Application has already been made to the government for permission to start the factory as the site selected is government property. Similar species of whales are to be found in the waters off Ceylon as are found in the Antarctic and Northern Atlantic.

Stedman Hammer Mills



Stedman Type A Hammer Mill

Stedman's Foundry & Machine Works, of Aurora, Indiana, have entered the field of swing hammer mills with a complete line of swing and ring hammer crushers, grinders, pulverizers and shredders. The Stedman Company maintains District sales offices in Atlanta, Philadelphia, Los Angeles and San Francisco, and Agencies in all principal cities throughout the country. The new line of hammer mills comprises three types and twenty-five sizes of mills, ranging from 5 to 250 horsepower sizes. The type "A" mill, illustrated herewith, a general purpose machine is produced in nine sizes. It is especially designed for fine and semi-fine grinding and pulverizing, and is said by the makers to be suitable for the successful handling of more than a hundred different varieties of material.

Chinese Peanut Market

According to a cable to the Bureau of Foreign and Domestic Commerce from the Consul General at Peiping the total shipments of Chinese peanuts to all countries during November, the opening month of the 1930-1931 peanut season were as follows: From Tsingtao, shelled, 31,862,800 pounds, unshelled 7,161,400 pounds; from Chefoo, shelled, 1,061,500 pounds, unshelled 6,879,000 pounds; from Tientsin, shelled, 999,500 pounds, unshelled 1,804,400 pounds.

The feature of trading was buying from China ports, which was 13 percent in advance of last year. Shipments to Europe from Tsingtao were 4,204,000 pounds in excess of the opening month last year, some shipments applying on contracts made as far back as August. The United States and Canada were indifferent, shipments to these countries being unimportant and well below the same month of last year.

Local oil mills have resumed crushing and will consume about 150 tons of shelled nuts daily. Quotations for peanut oil were on a par with a year ago, although prices of the nuts declined heavily during November on account of exceptional harvest and lack of buying interest for the forward months. Low silver exchange also contributed to the decline in prices for peanuts.

Mexican Lard Plant

A new plant costing in the neighborhood of $40,000. was opened in Nogales, Mexico, in December by two well-known American companies which are pooling their interests on the West coast of Mexico. These companies, which have incorporated in Mexico under the name of Empacadora de Manteca, S. A. are well established in the domestic field in the United States.

The plant will be located at the railhead of the Southern Pacific Railroad of Mexico so that its product will easily reach the consuming centers of western and southern Mexico. The company will handle principally unrefined lard which will be shipped from their centers in midwestern United States in tank cars. The plant will have the capacity of approximately a carload of lard daily.

The Mexican import duty on refined and unrefined lard is 15 centavos (about 7 cents) per kilo, plus 10 percent, plus 2 percent on quantities up to 50 kilos. In larger quantities the duty is 10 centavos (about 5 cents), plus 10 percent plus 2 percent. The new company, by importing in tank cars and packing the lard in containers in Mexico, will make a saving of five centavos (about 2 cents) per kilo, amounting to over 90 cents per hundred pounds. Lard is said to be one of the largest items of import from the United States through the port of Nogales.

The temporary prohibition on the exportation from Brazil of olive oil and lard, established by decree of October 7, has been repealed by Presidential decree, and the products may now be freely exported.

For the quarter ended November 30, the Archer-Daniels-Midland Company, reported a net income of $353,591, after depreciation and federal taxes. This was equal to 52 cents a common share after preferred dividends, and compared with $458,165, or 71 cents a share reported in the corresponding quarter last year.

ABSTRACTS

David Wesson, *Abstract Editor*

The resin and fatty acids occurring in "tallol" (the liquors obtained in the sulfate and soda processes of wood pulp manufacture) may be freed from their soaps by treatment with sulfite waste liquor and the free acids extracted with a solvent such as benzol. After removal of the solvent, the resin acids may be separated from the fatty acids. Ger. Pat. No. 503,030.

Recently developed phenol resinoids which are soluble in drying oils are said to produce varnishes which dry faster, are harder, more elastic and more durable, as well as more resistant to boiling water and soap solution than are similar varnishes prepared with ester gum in place of the phenol resinoids. *Ind. Eng. Chem.* 22,1177-80 (1930).

Fats, waxes or resins are readily oxidized at elevated temperatures by means of a current of air if they are present in a liquid condition and mixed with solid materials of large surface area such as clay, powdered aluminum or glass. U. S. Pat. No. 1,780,632.

Cacao butter and its substitute may be classified by the freezing point method. Butters from normal beans, properly fermented and roasted, give very similar freezing point curves. A defective butter is recognized by depression of the maximum and minimum temperatures, together with a slow setting. A similarity in the cooling curves of cacao butter and any other fat indicates that fat is suitable for chocolate manufacture. *Analyst* 55,477-87 (1930).

In the determination of the moisture in soap by distillation of the water with xylene, accurate results are dependent upon the form of condenser used. The recommended type is internally suspended with outer jacket. A graduated tube connected to the bottom of the condenser enables the return of clear water-free xylene to the distillation flask. The turbid mixture of water and xylene is then transferred to another graduated tube and centrifuged, the volume of water being read for the percentage determination. *Chem. Ztg.* 50,962 (1930).

For the emulsification of tars, oils, fats, resins, cresols and the like, in admixture with substances such as sulfur, phorphorus, arsenic or selenium, if desider, emulsifying agents are prepared by treating products, obtained by the oxidation of animal, vegetable or mineral waxes with gaseous oxidizing agents, with 20-40% of their weight of chlorine at a temperature below 100°C., and subsequently treating the chlorination products so obtained, with basic reagents. Brit. Pat. No. 321,239.

The beta-eleostearic acid of China wood oil is said to have an iodine number which varies with the duration of exposure to iodine and with the excess of iodine used. The iodine absorption curve also shows a decided break at 180 iodine number, indicating a tetraiodide which upon long-continued iodine action becomes finally a hexaiodide. *Chem. Umschau, Fette, Oele, Wachse Harze* 37-269-71 (1930).

Wood and nearly all vegetable tissues as well as various animal, vegetable and mineral oils act on sensitive photographic plates in the absence of light, forming dark images, known as the Russell effect. The usual explanation of the phenomenon is that hydrogen peroxide or ozone is given off during slow oxidation and that these cause the effect. If air is excluded no effect is produced. Recent experiments have shown that in the case of fatty oils, the activity is not due to peroxide or ozone, but to butyric acid, which is one of the oxidation products of the oils. *Trans. Roy. Soc. S. Africa* 18-295-300 (1930) *Chem. Abstr.* 24, 6045-6 (1930).

Some experiments of J. Davidsohn on mixtures of rancid fats with fresh fats have convinced the experimenter that the Kreis test is an unreliable criterion for rancidity of fats and that the Wiedemann-Kreis modification, which uses acetone in place of ether and sulfuric acid instead of hydrochloric, is likewise unreliable. *Chem. Umschau Fette, Oele, Wachse Harze* 37,193-6 (1930).

OIL & FAT INDUSTRIES

The Editor's Page

Legislative Sharpshooting

AGAIN we have in Washington a sorry spectacle. The Congress of the United States, in frantic endeavor to impress the voters on the farms, is entertaining all sorts of proposals of discrimination against a sound, healthy food product, prepared in the most scrupulously clean manner, in plants of sanitary construction and operation.

The art and skill of the chemist and chemical engineer have dared to improve the technique of margarine manufacture to the point where the criticisms of the dairy interests are losing weight with the consuming public. Margarine now contains ample amounts of those vitamins said by the High Priests of the Milk Pail to be essential to our well-being. Margarine now has a texture satisfactory for spreading upon our bread at any temperature and under any climatic conditions. Suitable oils have been prepared which, while imparting these desirable properties, also possess, by gift of nature, a natural color not unlike the color imparted to June butter by the healthful grasses of the meadows.

These grasses are *vegetable*, not *animal*, products, and every farmer boy in the land knows that it is only in the months of fresh young grasses that butter comes from the churn with that golden color which is being set up as a fetish by the creamery interests. Everyone who is familiar with creamery practice knows that during nine months of the year those same creamery interests add annatto, a vegetable coloring matter derived from a South American tree, prepared under conditions of doubtful sanitation, and dissolved in cottonseed oil, to their pure cows' product, in order to simulate, for the dear consuming public of whose welfare they are so solicitous, the color of June butter.

Why has the Bureau of Internal Revenue precipitated this agitation at this time? Under the oleomargarine act as written and enforced for many years, the use of ingredients in margarine, (in quantities over ten percent), which impart a natural yellow color has been countenanced without attempts to collect the ten cent per pound tax assessed against artificially colored goods. That the Bureau has ruled out palm oil in former years has shown only the ignorance of refining technique of those who have made the rulings. Properly refined palm oil was just as wholesome and edible ten years ago as it is today, and in ruling it so the Bureau has only rectified its previous error in the intepretation of the law.

Will our Congress ever learn that they cannot control Nature, Progress and Science by legislation? Who shall say that the products of any one branch of the fatty food industry shall have a Trade Mark or Copyright property in a shade of Nature's colors, freely given to all mankind impartially? In this *free* country of ours, the workingman is now denied the right to buy or make Nature's malt or vinous products, because those who usurp the power of dictation say "Thou shalt not." If this practice is to be extended to those triumphs of creative science which contribute wholesome new products to our domestic economy, let us, by all means, return to the days of feudal seigneurs and the Inquisition.

Avoiding the Obvious

SOME months ago it was our pleasure to listen to a short informal talk by a successful chemical engineer and patent attorney, who entitled his remarks "The Avoidance of the Obvious." He cited many instances in his experience of apparent effort upon the part of research investigators to find complicated solutions to their problems, resulting in neglect of the simple, effective answers which should have been obvious.

The cottonseed crushing industry of this country seems in a fair way to furnish a parallel example.

At great expense of time and effort, a committee of the National Cottonseed Products Association has discovered and now announces that the crushing capacity of the country so far exceeds the amount of cottonseed available that the average utilization of facilities for the past three years has been 38 per cent of capacity. The committee has also shown, by careful analysis of indisputable data, that those mills which have made any sort of profit whatever have been those which have been operated at

the greatest percentage of their capacity. These facts are incontrovertible and must be admitted, but wherein lies the remedy?

Shall the mills continue their ruthless competition of the past few years, all losing money, (or making less than simple bank interest on their investment), until the weaker units are driven to the inevitable end of all marginal producers? Shall the producers of cottonseed oil attempt to sell their products only at prices that will fully meet all the Idle Plant Charges that must be imposed for equipment which stands rusting over half the time when it should be doing useful work, thus inviting and giving an advantage to the competition of oils other than cottonseed?

The answer, as hinted in our title line, is surely obvious. The cottonseed crushers of the South *must* awaken to the fact that an oil mill is an *oil* mill, not a cottonseed oil mill. They must look beyond the borders of their adjacent cotton fields for raw materials with which to keep their rolls turning, their cookers steaming and their presses rising. That this is possible has been demonstrated for many years by all the oil mills of Europe, where native raw material is almost entirely lacking, but where great mills keep in operation throughout the year entirely on varieties of imported seeds and nuts. If we cannot produce tropical oil-bearing seeds in this country we can surely best meet their competition by importing them for the winning of their oil in our machinery.

Any cottonseed oil mill can be adapted, at slight cost, to the alternative handling of a variety of products other than cottonseed, without in any way impairing its efficiency in operation on its available quota of that seed. Where else is to be found the salvation of the business?

Procter & Gamble Earnings Increase

Procter & Gamble Co., Cincinnati, earned $12,194,732 during the six months ended December 31, 1930, after depreciation charges and advertising expense. This was equal to $1.90 a share on the 6,410,000 common shares outstanding June 30, 1930, and compared with earnings of $10,811,000 for the first six months of the year. During the fiscal year ended June 30, 1930, the company earned $22,450,600, or $3.38 a share on the common stock outstanding. The increase in earnings during the last half of the year was partially attributed in financial circles to economies effected through the acquisition of James S. Kirk & Co. early in July of 1930. It was also due, no doubt, to a continued decline in prices of fats, oils, perfuming materials and chemicals during the second half of the year.

Shortening and Oil Prices

Prices of shortening and salad and cooking oils on Thursday, January 29, 1931, based on sales made by member companies of the Shortening and Oil Division of the National Cottonseed Products Association, were as follows:

Shortening

	Per lb.
North and Northeast:	
Carlots, 26,000 lbs.	@10
3,500 lbs. and up	@10¼
Less than 3,500 lbs.	@10¾
Southeast:	
3,500 lbs.	@ 9¾
Less than 3,500 lbs.	@10¼
Southwest:	
Carlots, 26,000 lbs.	@ 9¾
10,000 lbs. and up	@ 9¾
Less than 10,000 lbs.	@10¼

Salad Oil

North and Northeast:	
Carlots, 26,000 lbs.	@10
5 bbls. and up	@10¼
1 to 4 bbls.	@10¼
South:	
Carlots, 26,000 lbs.	@ 9¾
Less than carlots	@10

Cooking Oil—White

⅛c per lb. less than salad oil.

Cooking Oil—Yellow

¼c per lb. less than salad oil.

The cooking fats most in demand in the Netherlands East Indies are coconut and peanut oils and pork fat, all of local production. It is therefore not surprising that foreign cooking fats do not attain wide popularity. Margarine is used by Europeans in the "Outer Possessions" for cooking purposes and sells at a lower price than lard. The "Outer Possessions" embrace all the islands of the Netherlands East Indies except Java and Madura. Practically all the margarine used is imported from the Netherlands.

A New Method for the Examination of Textile Oils

An Original Procedure for Measuring Oxidizability to Predetermine Desirability of Oils for Textile Purposes

By RALF B. TRUSLER[1]

PART I

RANCID odors, stickiness, and instances of spontaneous combustion — all of which are manifestations of oxidation —have led investigators to search for a means of predetermining the desirability of any fatty oil or fatty acid for textile purposes. The determination of the usual constants of fatty oils and acids has little bearing upon their behavior after they have been spread out in thin films upon either vegetable or animal fiber. Some method for measuring their oxidizability was obviously needed.

Types of Apparatus Requiring an Absorbent for the Oil

ONE of the earliest methods for testing a textile oil was proposed by Mackey, who devised the Mackey Cloth Oil Tester (*Fig.* 1). It consists of a jacketed chamber into which is inserted a basket made of wire screen or other porous material. Fourteen grams of the oil to be tested is absorbed in 7 grams of cotton waste and placed in the basket. A thermometer with bulb placed in the center of the sample provides a means for observing the rise in temperature of the specimen. The container is first heated to approximately 100° C., the basket with the sample is put in place, and heating is continued. An arbitrary method states that a satisfactory oil should not exceed 100° on the thermometer in 30 minutes nor exceed 200° in one hour. Many arguments for and against this method have been given. The chief complaint seems to be the inability of different laboratories to obtain check results. Its simplicity is its chief advantage. One investigator[2] has demonstrated that check results in close agreement can be obtained on the same apparatus when due precautions are taken, and Aspegren[3] used a modified Mackey tester in making excellent comparisons between cottonseed oils containing variable amounts of free fatty acids. The Mackey method does not permit the examination of oils below 100°; this is a disadvantage because experience has shown that some fatty oils contain natural antioxidants which decompose at this elevated temperature. Factory conditions rarely require stability at 100°. More often, freedom from the effects of oxidation at 20° to 50° C. would be entirely satisfactory. Furthermore, this or any other method involving the recording of heat by means of a temperature registering device placed in a more or less insulating body like oiled cotton fiber is subject to peculiar errors, which will be described later.

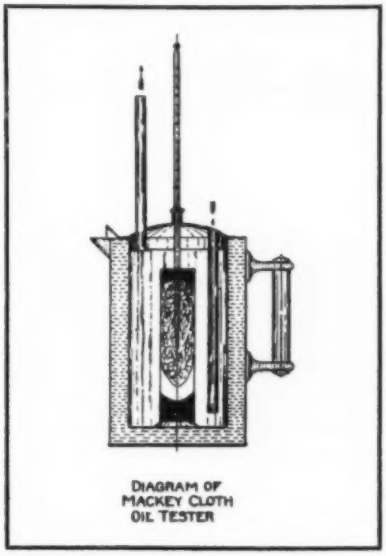


Fig. 1

In order to reduce radiation losses, Thompson[4] devised a tubular heater provided with an oil

[1]Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.

[2]R. E. Healy, Harkness & Cowing Co., Cincinnati, Ohio.

[3]H. Aspegren, Oil and Fat Industries, *6*, 19 (1929).

[4]N. J. Thompson, Industrial and Engineering Chemistry, *19*, 394 (1927); Oil and Fat Industries, *5*, 317 (1928).

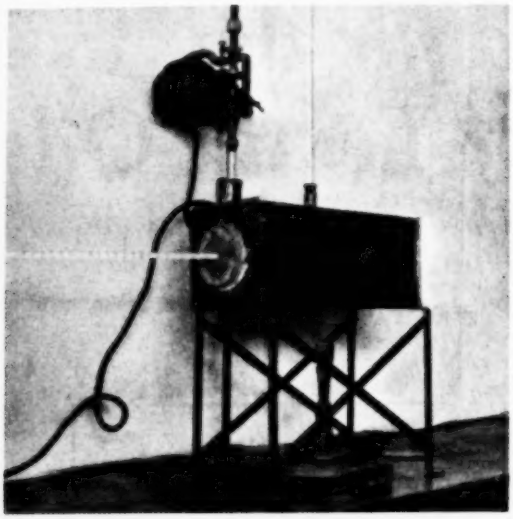


Fig. 2

jacket. The method was found to have advantages over the Mackey tester in that greater differences could be measured between different oils. A somewhat similar device of sheet copper (*Fig. 2*) was constructed in this laboratory for further study of the procedure. The heating compartment was 2½ inches in diameter and 12 inches long, surrounded by a jacket filled with oil. The temperature of the oil was maintained uniform throughout by means of a motor stirrer. It was hoped that this modification of the principle of the Mackey tester would provide a means for studying accurately the rate of oxidation of an oil at any temperature and for comparing oils in regard to their resistance to oxidation. It has been reported that, in using the Mackey tester, the results obtained vary with the type of fiber employed to absorb the oil sample and also vary with the amount of oil. Thompson observed these effects in his oil tester, and selected for convenient operation cotton waste as the absorbing medium and an optimum weight of oil.

If oxidation of an oil spread upon fiber of any sort is to proceed at a maximum rate, the reaction should be facilitated by providing a given sample of oil with a large surface of contact with the oxidizing medium. When oxidation takes place in air and in a device such as the Mackey tester or any modification, the greatest convenient surface is provided by wool, cotton, glass wool, or some other fine fiber. Experience has shown that wool and cotton fiber are most conveniently handled, and for economy and accessibility cotton fiber has the advantage. Furthermore, pure, greaseless, absorbent cotton is readily obtainable. Wool fiber has one advantage over cotton fiber in that it is more easily wetted with fatty oils.

It was found that considerable care was required to distribute the oil evenly upon the cotton fiber, and it should be mentioned here that unless the oil is evenly spread out upon the entire sample of cotton, ridiculous deviations in similar tests result. Thirty grams of absorbent cotton was unrolled into thin strips so that its area when spread out amounted to about 20 sq. ft. It was then sprayed with 15 grams[5] of oil and was rolled up into a bundle eight inches long to fit the tubular heating chamber. A thermometer was inserted in the center of the roll, and the outside was covered with a single piece of thin paper so that the roll might be easily slipped into the heating tube of the testing device.

After the oiled specimen of cotton had been placed in the heater, each end of the tube was partly closed by inserting a transite plug or stopper, through which were drilled four holes ¼ inch in diameter near the circumference and one ¼ inch hole in the center. The thermometer protruded through one of the center holes. Oxidation of the oiled cotton was brought by heating the oil jacket. In accordance with the recommendation previously made for this type of apparatus[6], the procedure consisted in keeping the oil bath 2° hotter than the temperature indicated by the thermometer in the specimen, and in making comparative readings upon the thermometer in the bath and that in the cotton. During the early part of the heating this is easily done, but during the last stages of the test the rapid rise of the temperature of the sample makes the control difficult. However, owing to a long heat lag through the cotton, very little error is caused from this source during the last twenty minutes of the experiment. By plotting the readings of temperature inside the roll of oiled cotton against time of heating, curves were obtained, some of which are shown in *Fig. 3*.

Peculiarities in the results made this method for examining oils inapplicable to the problem

[5]Fifteen grams of oil was chosen as an optimum quantity because larger amounts had a tendency to drain off the cotton fiber and collect in the bottom of the heating tube.
[6]N. J. Thompson, loc. cit.

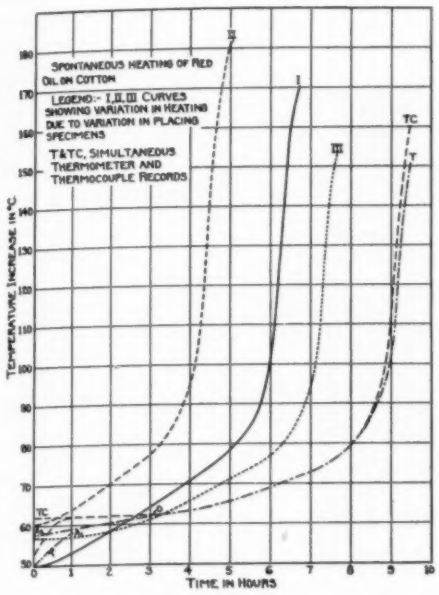

SPONTANEOUS HEATING OF RED OIL ON COTTON
LEGEND:- I, II, III CURVES SHOWING VARIATION IN HEATING DUE TO VARIATION IN PLACING SPECIMENS
T&TC, SIMULTANEOUS THERMOMETER AND THERMOCOUPLE RECORDS
TEMPERATURE INCREASE IN °C.
TIME IN HOURS
TC
T

Fig. 3

at hand, as is illustrated by the curves, I, II, III, TC and T in *Fig.* 3. As was stated before, in most industrial work one is concerned with the stability of an oil at ordinary temperatures, for if an oil resists oxidation at temperatures of 25° to about 50°, there is very little opportunity for it to heat up spontaneously to accelerating temperatures. Hence, a suitable method for studying the resistance of an oil to oxidation must be one that permits an accurate history of its behavior at any temperature, a condition practically impossible with the Mackey tester or any modification of it.

Referring to the curves I, II and III, it will be observed that from 80° upward the curves are nearly identical, and that almost three hours difference in time was required to reach 80° for the specimen in the heater, represented by curve III, as compared with curve I, while the oil and cotton were identical in cases I, II, and III. If the time displacement upon this chart indicated a difference in three different oils—and, for example, it could be said that the oil represented by curve II became heated to 70° in two hours, while the oil represented by curve III required about five hours—it could then be stated that oil III showed a marked resistance to oxidation and therefore was much safer to use than oil II. However, the specimens are identical and the great deviation in the curves is due simply to the manner in which the specimens were placed in the heating compartment. An ideal sample (seldom equalled) gave the results shown by curve I, but if the cotton fiber were somewhat fluffier and slightly elongated in the heating tube, more rapid oxidation was obtained (curve II) while if the specimen was just slightly more compact, oxidation took place more slowly (curve III). Numerous experiments were made in an attempt to secure duplicate results, but these were obtained only occasionally.

An interesting experiment was conducted in order to determine the nature of the curve during its early, gradual slope. A specimen of oiled cotton was prepared in the usual manner. The thermometer was placed near the center of the roll as usual, and a thermocouple was placed one inch from the thermometer bulb and led off through the opposite end of the tube so that it did not come in contact with the thermometer. The jacket was quickly heated to 62° and maintained at constant temperature. A period of one hour was required for the thermocouple to reach the temperature of the bath, while the thermometer required about four hours. Although oxidation of the oil was progressing constantly during the three hour period represented by the portion of the curve TC to 0, not the slightest difference could be detected between the temperature of the oil bath and the cotton, as indicated by two similar thermocouples. This and other experiments demonstrated that temperature indicating devices have little opportunity for successful application to a problem of this kind, except where sufficient heat is evolved from rapid oxidation, as shown by the steep part of the curve.

A frequent lack of uniformity in degree of oxidation throughout the mass of cotton fiber is another reason why this type of apparatus gives inconsistent results. In some instances, after 150° to 160° was indicated by the thermometer in the cotton, the reaction was stopped as quickly as possible by pouring out the hot oil in the jacket and refilling with cold oil in order to arrest the reaction. When an inside temperature of 70° to 75° was indicated, the specimen could be moved without danger of catching fire. Specimens removed in this fashion demonstrated how diversely the oxidation can take place. Although great care was always taken in distributing the oil evenly upon the fiber and in rolling up the oiled cotton into a parcel of uniform density, in some of the experiments oxidation proceeded uniformly throughout (*Fig.* 4), while in others it was so

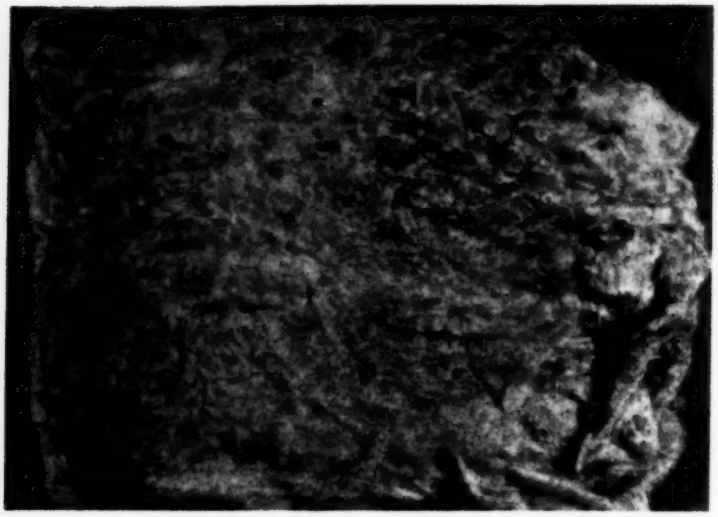


Fig. 4

Showing appearance of cotton fiber after being subjected to uniform oxidation in Mackey testing apparatus

intense in localized portions that the cotton actually charred (*Fig.* 5). Thus, in the latter case, nothing but irregular results could be indicated by the thermometer. Upon reviewing these experiments, it was obvious that any method dependent upon measurement of heat of combustion could not conveniently assist in the solution of the present problem. Although special calorimeters were considered, no attempt was made to utilize them because it was suspected that erroneous results might also be obtained from another source, namely, the entropy change due to polymerization, which takes place to a high degree with some types of fatty oils.

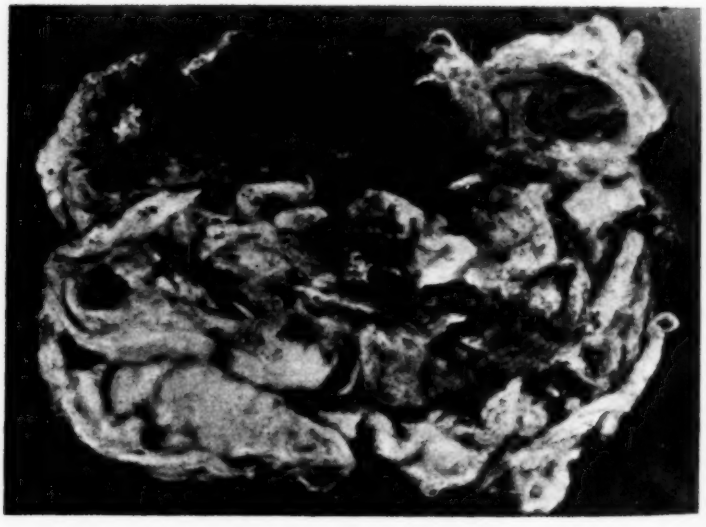


Fig. 5

Cotton fibre after undergoing oxidation in Mackey testing apparatus under conditions resulting in lack of uniformity, with partial charring

Apparatus for New Method of Testing Oils

THE problem of measuring the susceptibility of an oil to oxidation involves only two materials, oxygen and oil, and it would therefore be most desirable not to introduce any other ingredient. Various types of apparatus were constructed in order to arrive at a satisfactory means for measuring the amount of oxidation at any temperature and for comparing the values of anti-oxidants. The experimental work demonstrated that quantitative oxidation of an oil wholly or only in regard to a double bond is not necessary, nor even an exactly desirable accomplishment, owing to the wide variations in composition of oils, which would thus require a complete knowledge of their constitution before an examination was made. Partial oxidation under uniform conditions permits a satisfactory examination since the susceptibility of an oil to oxidation is the important factor.

The apparatus that was designed for this investigation is shown in *Figures* 6, 7, 8, 9, 10, and 11 and consists of three parts: (1) the reaction bulb, (2) the gas measuring device, and (3) the shaker. The recation bulb (*Fig.* 6) in which the sample of oil and oxygen is contained, is made of pyrex glass and is approximately 138 mm. long and 40 mm. in diameter; it contains approximately 130 cc. This capacity accommodates 25 grams of oil and 100 ml. of oxygen. An inlet for oxygen is provided by a capillary tube, with a stop-cock attached to the top of the bulb. The sample of oil is admitted through a separate capillary tube (with cock) with an inlet near the bottom of the bulb.

REACTION BULB

Fig. 6

The gas measuring device (*Figs.* 7 to 10) consists of a leveling flask A, containing mercury, a balancing manometer B, and a gas burette C. The leveling flask, of 300 ml. capacity, contains sufficient mercury to fill the tubing, to maintain a column in the stem S of the balancing manometer, and to fill the gas burette C. The flask is adjustable to any level by means of the ring clamp which moves along the iron support.

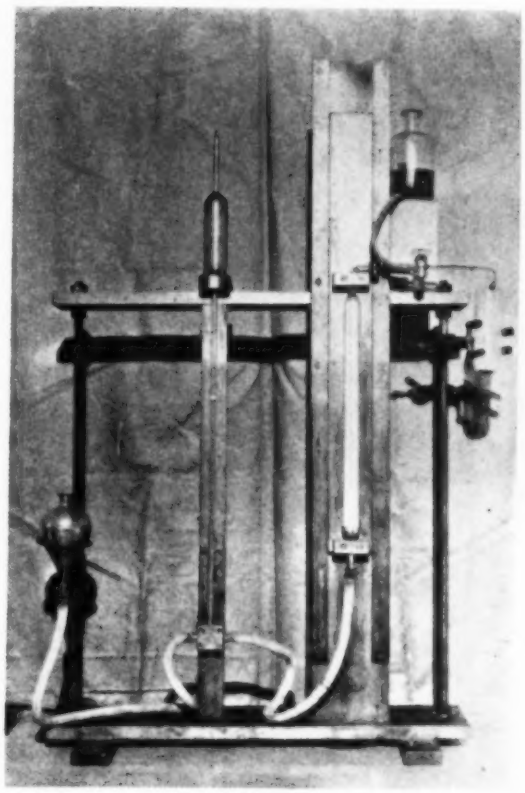


Fig. 7

The balancing manometer, B, serves as a means for attaining a standard pressure in the gas burette C when a volume of oxygen is to be determined. When the gas burette is at any given level. (*Fig.* 8) and the mercury column in the stem of the balancing manometer is at the same level as the mercury in the burette (indicated by the line L L), obviously the gas pressures in the two systems are equal. The proper level of the mercury in the stem of the manometer is determined in the manner described below, and is indicated by a mark M on the stem. If a volume of gas is admitted into the burette and the positions of the burette and leveling flask are adjusted so that the levels of the mercury in the stem of the manometer and the burette are identical at M, then the volume of a gas in the burette can be accurately measured in respect to the gas in the mano-

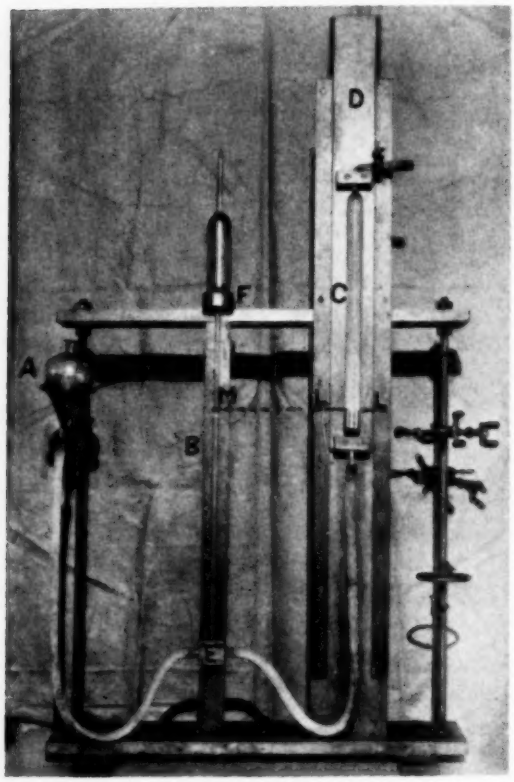


Fig. 8

meter and can also be compared with any other volume at any time, since in the two systems $P_1 = P_2$ and $T_1 = T_2$.

The balancing manometer B is constructed from a 100 ml. pipette. The tip should first be drawn out to facilitate its final sealing, and a stop-cock is sealed at the long end to aid in standardization. The problem now is to standardize the pipette at 20° (same as burette) and 760 mm. pressure. To find the volume occupied by 100 ml. at 20°, it is necessary only to draw up into the pipette 99.82 to 99.84 grams of water from a beaker upon a balance. The correct amount is easily obtained by means of the stop-cock, and the fine tip at the end of the pipette. The stop-cock is then closed and the pipette is inverted so that the water will drain out of the capillary tip, which now can be gently sealed on the end with a flame. The pipette is then inverted, tip down, and bubbles of air are displaced by careful manipulation. It is then immersed in a deep container of water at 20°, and, when sufficient time has elapsed to reach uniform temperature, the position of the meniscus should be recorded on the stem. One other mark should be established in the same way for 105 ml. The distance between the marks indicates the volume occupied by 5 ml. and can be divided into milliliters by marking off the divisions on a narrow strip of paper pasted on the stem. Any position on the stem of the pipette, which is to be the manometer, may be taken as the point M for leveling, as shown in *Fig. 7*, but in order to have some standard for reference so that identical results may be had upon another similar apparatus, or if the manometer has to be replaced, it is necessary to select a point corresponding to a known pressure. For convenience, the point corresponding to 760 mm. pressure was selected. The position on the stem is calculated by the relation $V = \frac{76 \times 100}{P}$ where P is atmospheric pressure. Then V – 100 is the increase in the volume of the gas at the present atmospheric pressure. For ex-

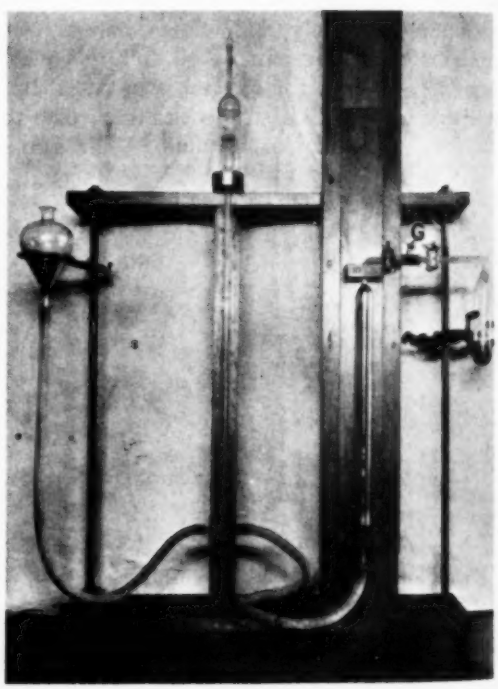


Fig. 9

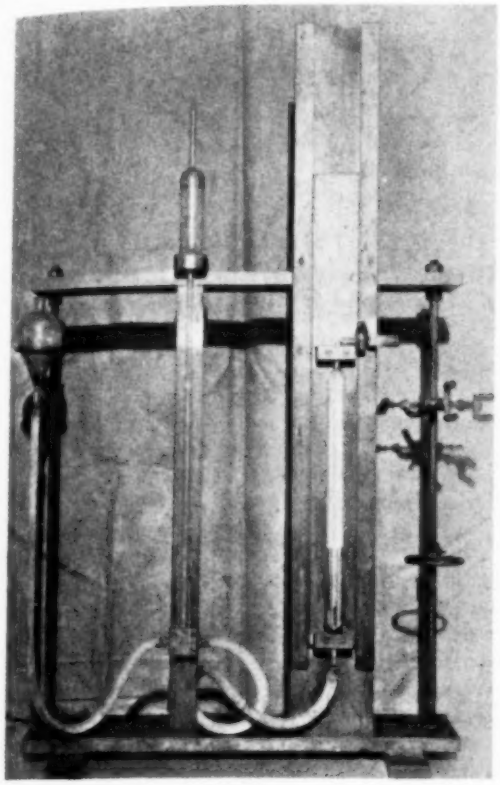


Fig. 10

ample, if the atmospheric pressure is 740 mm. while the pipette is being filled, 100 cc. at 760 mm. (assuming temperature constant at 20°) will occupy $\frac{760 \times 100}{740}$ cc. or approximately 102.7 cc. This calculated point should be marked upon the stem of the pipette, and a correction is also indicated for room temperature over or below 20°. A small portion of the tip is now broken off and the water is drained out.

The stop-cock should be cut off and an extension with a "T" should be put in its place so that the entire length of the stem below the bulb is approximately 50 cm., as illustrated by *Fig.* 11. The pipette, which now constitutes the manometer, is mounted on the support (*Fig.* 9). The weight of the manometer is supported by the bracket F, and the glass "T" is protected by a wood block E, cut to fit. The manometer is connected to the leveling flask and to the burette with pressure tubing. Mercury is poured into the leveling flask until it overflows through the stop-cock, at the top of burette, which is closed to retain the mercury. A convenient elevation for the burette is shown in *Fig.* 7. Care must be taken to dislodge all bubbles of air in the rubber tubing. The next step is to raise the leveling flask high enough to send the mercury to the top of the manometer stem, thus displacing all the air. Then by lowering the flask and thus adjusting the level of the mercury in the manometer stem, dry air is drawn into the manometer until the meniscus stands at the mark (calculated for 100 ml. of gas at 760) at the atmospheric pressure and temperature at the time of filling (102.7 ml. in the case illustrated). The tip of the manometer is sealed with a blow torch. Although the mark first determined for 100 ml. at 20° is the one to be used(referred to as M— it would be well to preserve the milliliter calibration marks on the stem in case the manometer has to be opened and resealed at any time as this would do away with much unnecessary work.

The gas measuring burette, to which reference has frequently been made, is a standard 100 ml. gas burette provided with a stop-cock. The burette is held in place by wood cleats fastened to a support D, which slides in grooves and can be secured at any elevation by means of a thumbscrew on the back.

The shaking device (*Figures* 12, 13) provides the means for oxidizing oils under conditions that can be controlled and duplicated. This is accomplished by causing thorough contact between an oil and oxygen contained in the bulb while it is shaken in a heated oil bath. The reaction bulb is clamped at the end of a rocker (*Fig.* 12) by means of two screws, one in each circular metal band. The bands need to be tightened only sufficiently to prevent the

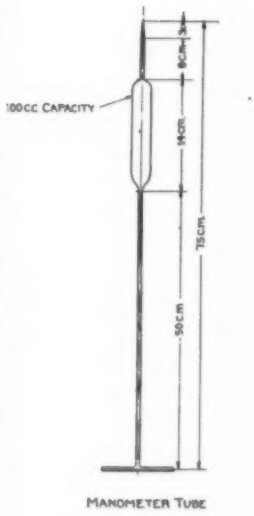


Fig. 11

(*Turn to page 77*)

The Determination of Water in Glycerols

*Describing An Adaptation of the Bidwell-Sterling Direct Distillation Method to Glycerine Analysis**

By L. F. HOYT *and* P. C. CLARK†

SEVERAL methods for the estimation of water in glycerol have been proposed, the most convenient classifications of the methods being as follows:

I. Direct Drying Method.

LAWRIE in his book "Glycerol and the Glycols" (1928) p. 296 describes in detail the duPont company's modification of the Rojahn[1] method of drying a weighed sample of glycerol over phosphorus pentoxide under reduced pressure of 12 to 15 mm. On samples containing up to 5% water it is claimed that results accurate to within 0.05% absolute error may be obtained. This method is, however, time-consuming, requiring at least 24 hours elapsed time, and is rather cumbersome.

Note: This same method, given in Allen's Commercial Organic Analysis 5th ed. Vol. II, 721, was used by Mr. Church in the Analysis of the Standard A. O. C. S. Crude Glycerine.

II. Electrical Conductivity Methods

SCHMIDT and Jones[2] in 1920 proposed to determine the amount of water in glycerol by means of conductivity measurement of 3 electrolytes, LiBr, $CoCl_2$ and KI dissolved in the glycerol.

More recently Kameyama and Semba[3] worked out a formula by which the amount of water present in glycerol is determined by a single measurement of the specific conductance, at 25°C, of a solution of 471 mgs KCl in 100 cc of the glycerol sample, viz:

$K \times 10^6 = 2.24 + 0.38n + 0.0127n^3$

K=specific conductance at 25°C.
n=cc water per 100 cc of sample (i.e. % by volume)

III. Method Based on Chemical Reaction with the Water Present

LAWRIE p. 298 describes briefly such a method. Hulburd (*Thesis, Univ. of Vermont,* 1920) proposed to estimate the water in glycerol by measurement of the amount of acetylene generated when calcium carbide was caused to react with the glycerol sample.

IV. Distillation Methods

BERTH[4] in 1927 proposed a new method in which glycerol was distilled with tetrachlorethane, measuring the water to 0.01 cc Berth claimed that the addition of 2.5 grams of finely powdered silver nitrate to the distillation mixture of 150 cc tetrachlorethane and a 100-gram sample was necessary. The special apparatus used by Berth is that described by Tausz and Rumm, *Z.angew. Chem.* 39, 155 (1926) for the determination of water in a variety of products such as flours, breads, yeast, butter and petroleum. Berth claims the determination requires only 45 minutes. On dynamite glycerines claimed to contain from 0.4 to 1.3% moisture he obtained recoveries as follows:

0.7	—	found 0.63
0.4	—	found 0.48
1.3	—	found 1.36
0.6	—	found 0.51

Riesener and Kessen[5] investigated this method and claim that the addition of silver nitrate causes high results and that accurate and concordant results are obtained only when it is omitted.

The method used by the authors of this paper involves no new principles. It is merely an adaptation of the Bidwell and Sterling distillation method.[6] Bidwell and Sterling mention in their article that one of the disadvantages of their method is that substances miscible with water and volatile with steam such as glycerol, alcohol, acetone, etc. are liable to distill over and cause high results.

We have applied the Bidwell-Sterling method to the determination of water directly in sev-

*Presented at Fourth Annual Fall Meeting, American Oil Chemists' Society, Chicago, November 13, 1930.

†Research Department, Larkin Company.

eral glycerols, using toluol as the boiling liquid, and have found that the amount of glycerol which distills over is very small; nearly within the limit of error of estimating the volume of water in the distillate.

(Note: In the Bidwell-Sterling distillation tubes as purchased the tube which projects into the boiling flask is cut off at an angle of about 45° sloping away from the graduated receiving tube. The result is that part of the liquid toluol refluxing back into the boiling flask is frequently caught and carried back up the tube by the vapors of the boiling toluol causing an accumulation of liquid in the condenser with resulting boil-over and the danger of a fire. If the 45° slope of the tube is reversed the liquid toluol has a much better chance to flow back into the flask and a more even distillation results.)

Table I shows the results of analyses by this distillation method.

Apparatus for the determination of water in glycerols

Procedure

IN analyzing dynamite glycerol use a sample of 50 grams or over; for C.P. and crude glycerols use 25 to 50 grams; for more dilute glycerols use a sample which will yield less than 5 cc water.

Weigh sample to .01 gm into a 1-liter round bottom Pyrex flask and add 300 cc toluol. Fill the graduated stem of the calibrated Bidwell-Sterling tube with water—saturated toluol, connect to condenser and distill with the aid of an electric flask heater until no more droplets of water come over, which usually requires about 1½ hours. Any droplets of water adhering to the condenser tube should be rinsed down with additional solvent, using a copper wire loop to aid in dislodging the droplets if necessary.

TABLE 1

Type Glycerol	Wt. of Sample	Volume Distillate	Apparent per cent Water	Grams Glycerol in distillate	Per cent water, corrected (a)	Non-volatile residue (b)	Glycerol, by Acetin Method (c)	Sum a+b+c
Dynamite	50.00 gm	0.17 cc	0.34%	0.009	0.33%	None	98.60%	98.93%
C.P.	50.65	2.75	5.44	0.029	5.38	None	93.46	98.84
C.P.	24.38	1.37	5.62	0.041	5.48	None	93.45	98.94
Composite Soap Lye Crude.	42.59	2.21	5.18	0.039	5.11	9.40%	84.15	98.66
*A.O.C.S. Standard Crude ..	48.90	2.50	5.11	0.064	*4.99	10.28	**83.33	98.60
Saponification Crude	28.78	2.10	7.30	0.012	7.26	2.55	89.89	99.70
Dynamite+ added water (calc water content=10.37%)	25.00 glyc 2.80 water	2.93	10.54	0.036	10.39			
GPA—Radiator Glycerine ..	10.835	4.48	41.35	0.029	41.11	None	58.33	99.44
			Solvents other than Toluol					
C.P. (Xylol)	25.40	1.44	5.67	0.222	4.99			
C.P. (Isopropyl Ether)	24.26	1.85	7.63	0.002	7.63			
C.P. (Benzol)	25.69	1.25	4.87	0.005	4.87			

*On this Standard A.O.C.S. Crude Glycerine, Mr. Church in his letter to the Soap Section Committee of 2/28/30 reports that four laboratories reported 4.94—4.86—4.84—4.96% moisture or an average of 4.90%, by the P_2O_5—vacuum method.

**This value of 83.33% glycerol is the accepted average of the committee who analysed this sample.

Allow apparatus to cool and read volume of water.

$$\frac{\text{cc water in distillate}}{\text{wt. sample in grams}} \times 100 = \% \text{ water, by weight*}$$

*Note: Our results indicate that for C.P. and crude glycerols, containing about 5% water, this result uncorrected for glycerol which distills over will be about 0.1% high on the average. Where great accuracy is desired, separate the aqueous distillate from the solvent by rinsing the tube several times with distilled water into a separatory funnel. Draw off the water containing the glycerol into an acetylization flask, evaporate and determine glycerol by the acetin method. From the volume of the distillate and the grams of glycerol calculate the specific gravity of the distillate using the 20°C/20°C glycerol gravity tables. Then

calculate the weight of the distillate and deduct the weight of glycerol. The result will be the net weight of water in the distillate from which the corrected % water in the sample may be calculated.

Lack of time prevented us from attempting to apply the Kingman method[7] also to the direct determination of water in glycerols. It would be interesting to compare some chlorinated solvents including the official tetrachlorethane sp gr 1.582 b.p. 145°C, monochlorbenzol sp gr 1.113 b.p. 132°C and carbon tetrachloride sp gr 1.58 b.p. 77°C, using the Kingman method, with the results obtainable with a series of solvents of comparable boiling points using the Bidwell-Sterling method.

We did make three determinations of the moisture content of the C.P. glycerol by the Bidwell-Sterling method using first commercial isopropyl ether and later commercial benzol and xylol. The isopropyl ether used had a sp. gr. of 0.728 and a boiling range of 66-74°C. This solvent was entirely free from water yet the distillate obtained from a 25-gram sample of C.P. glycerol indicated 7.48% water, an impossibly high value. The aqueous distillate when analyzed for glycerol showed only 0.002 grams showing that very little glycerol is carried over by this low boiling solvent. The only apparently logical reason for the high moisture content obtained when using isopropyl ether as solvent is that perhaps a chemical reaction took place such as the dehydration of small amounts of isopropyl alcohol which may have been a minor constituent of this commercial solvent, thereby forming water. Commercial xylol, having a sp. gr. of 0.866 and a boiling range of 136 to 142° C when used as the solvent gave a value of 4.99% water in the C.P. glycerol. This solvent with its higher boiling point carried over a considerable quantity of glycerol—0.222 grams in a distillate of 1.44 cc.

It is an interesting fact that the time required to distill the water out of a sample of glycerol was practically the same for toluol and xylol. The bulk of the water comes over in the first half hour, while about 1½-2 hours are required to bring over the last traces. For rough control purposes the value after ½ hour distillation might be used, where toluol is the solvent. Commercial benzol boiling at 78-82°C gave a low result for moisture and required a longer distillation time. Of the four solvents tried, toluol only appears to give satisfactory results.

Summary

WATER in concentrated glycerols may be satisfactorily determined directly by the Bidwell-Sterling distillation method, using toluol as the boiling liquid. A variable but very small amount of glycerol is carried over with the water. In no case in our analyses did this glycerol carried over amount to as much as 0.10 gram, and the correction to the apparent per cent of water in the sample did not exceed 0.15% in any of the glycerols containing up to 10% of water.

The use of a solvent like xylol boiling appreciably above 100°C is not advisable since it causes considerably more glycerol to be carried over and does not markedly shorten the time of distillation. An analysis made by this method on a 25.00 gram sample of dynamite glycerol to which 2.80 grams of water was added, producing a sample containing 10.37% water, gave a recovery, corrected for .036 grams of glycerol carried over, of 10.39% water. On the A. O. C. S. Standard Crude Glycerine sample, Mr. Church reports that four laboratories found an average of 4.90% moisture by the P_2O_5-vacuum method. We found 4.99% moisture by direct distillation in this same sample.

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Whaling Companies to Restrict Killing

In a statement made at the annual meeting of the Hector Whaling Co. in London recently, it was indicated that in the future production of whale oil will be kept more closely in line with consumptive capacity. The company has rejected opportunities to secure interests in new expeditions. In the report the danger of promiscuous killing of whales is pointed out and doubts for the future of the industry are expressed. Representatives of the Norwegian whaling companies met with a number of representatives of foreign companies recently to consider the problem of limiting whale oil production to the demands of the markets.

Swift & Co., Chicago, elected Gustavus F. Swift president of the company to succeed Louis F. Swift who was recently made chairman of the board. Edward F. and Charles H. Swift, vice-presidents, have been made vice-chairmen of the board.

Detergents Committee Reports Progress

*Character and Scope of Committee's Activities Described, Although No Recommendations Offered at Present**

By JAMES G. VAIL[1], *Chairman*

DURING the past several years, we have been investigating washing processes. This effort has been directed only toward developing a test which shall properly evaluate and compare detergent materials applicable to laundry practice. The problem has proved to be a difficult one, owing to the large number of factors which enter into cleansing processes.

When one considers the wide variety in fabrics, the still greater number of kinds of dirt, the differences due to time, mechanical action, temperature, and concentration of liquids, the complexity of the matter becomes evident. Reduction of these variable factors to a minimum has been the first objective. Selection of a single uniform type of cloth, and of standard grades of pure soap, was comparatively simple. Not so, however, have been the questions relating to the character of the soil, the methods of applying it the treatment of the soiled cloth, and the judging of the results.

Character of the Soils

DURING the earlier part of the work, it was felt that a soiling material should resemble many types of ordinary dirt in containing a pigment and an oily material, either animal, vegetable or mineral. It was soon realized, however, that any given oil or grease could not be depended on to be identical at different times and places. Starchy materials were tried, but were open to the same objection as the oils. The trend of sentiment recently has been in favor of simple pigments, not because any one of them would closely represent ordinary dirt, but because of their constancy. This feeling of preference has been strengthened by the fact that the really difficult part of clean washing is in removing the last traces of pigments, which hold on long after all signs of oily or starchy vehicles have passed away.

Two pigments have received more attention than any others—carbon black and raw umber. Both of these have sufficient coloring power and are closely related to materials encountered in laundry practice. The former is open to the objection that many commercial grades do not disperse well in pure water, and so give a spotted effect instead of an even color when applied to cloth. Moreover, it is very difficult to remove the last traces of a well-dispersed black.

Methods of Soiling

WHEN oily and starchy soiling materials were being tried, attempts were made to apply them to cloth by printing or by suspending in a mobile vehicle such as carbon tetrachloride. These were not entirely satisfactory. Two methods of applying simple pigments in pure water have been found to give fairly even colors. In one, a suspension of about 5 gm of umber in 100 ml of water is made by stirring in the pigment. A strip of cloth, say 5 x 12 inches, is wet with water, stirred for a moment in the umber suspension, and passed between the rolls of a household clothes-wringer. The treatment is then repeated until the color of the cloth no longer changes. This is effected in 3 or 4 passes. The cloth is then shaken by hand with successive portions of water until the liquid comes away clear.

If a lighter shade is desired, it is better to have less umber in the suspension, and repeat the treatment until the desired color is attained.

The second method involves the use of the Launderometer, to be described under Methods of Washing. A piece of cloth, 3 x 5 inches, is folded once and sewed along the edges to

* *Presented at Fourth Annual Fall Meeting, American Oil Chemists' Society, Chicago, November 13, 1930.*

[1] Philadelphia Quartz Company.

form a bag of 3 x 2½ inches. Inside the bag are placed 50 balls of Monel metal (described below). Fifty more balls, the bag, and a suspension of 1 gm of umber in 100 ml of water, are placed in a jar and rotated for an hour with the temperature held at 60° C. It is thought that this method can be depended on to produce uniform results, time after time.

Methods of Washing

IN considering these, it has been recognized that many factors enter into the washing process. Detergents may operate in part by emulsifying oils, altering interfacial tensions, and in other ways. Determination of any one or more of these effects does not give the desired answer. The committee has felt that the only convincing test of detergent power is one based on the results of actual washing.

Many of the variable factors in the washing process have been brought under control in the Launder-ometer, made by the Atlas Electric Devices Co. of Chicago. This machine has a metal tank with rounded bottom, supported in an open framework. Through the middle of the tank extends a shaft, bearing 16 threaded posts. By means of clips and wing-nuts, twenty "lightning" jars may be attached. A motor with speed-reducing mechanism, rotates the shaft at about 40 r.p.m. The tank is filled with water to about the level of the shaft, when in use. Heat is applied by a perforated-pipe gas-burner underneath the tank. Rubber or metal balls may be placed in the jars to increase the mechanical action. Balls of Monel metal, ¼ inch in diameter have been found satisfactory.

The temperature, time of contact with the detergent solutions, their concentration and relative volumes, and the amount of mechanical action, within limits, can all be arranged at will. A temperature of 60° C is convenient to work with. There may well be a doubt, however, as to whether any one temperature is best for all detergents. To avoid the development of too much pressure, with consequent danger of leakage, it is well to heat the solutions before placing them in the jars. When a flat piece of cloth is used, it sometimes attaches itself to the lid of the jar and thus escapes the intended agitation. To avoid this, the piece may be made into a bag, as described above. An objection to this is that the seams, and parts close to them, do not wash as rapidly as the main part of the bag.

Judging the Results

EARLY in the work of the Committee it was thought that a numerical statement of the relative efficiency of two or more detergents might be obtained by noting the number of washings required to produce a given shade. A color chart was devised, for comparison. The results by several experimenters did not agree well enough to encourage adoption of this method. Another plan was to print the color in stripes across the cloth. Washing was to be continued until the marks ceased to be visible. Difficulties were encountered in judging when the stripes actually disappeared.

These two methods serve as illustrations of two different standards of judgment. To some it seems that, since clean washing is what is demanded commercially, perfect cleanness should be attained in any evaluation test. Others hold that practical value is shown better by the results secured during the early stages of washing. There is some hope that these views may be harmonized by plotting the early changes and from them deducing when perfect cleannness would be reached if washing were continued long enough. As worked out thus far, it has been found that the last traces of pigment persist with remarkable tenacity. To remove them an expenditure of time is required which some consider excessive and impractical. It has also been found very difficult to decide just when the last traces have disappeared. A help in this direction has been the use of an unsoiled blank which receives just the same treatment, in its own jar, as the soiled specimen. The end is reached when the two become indistinguishable. Even this is not as easy as might be expected. An interfering feature is the fact that detergents do not all give the same shade of white on unsoiled cloth. The last traces of pigment may harmonize better with one blank than with another.

If judging is done during the early stages of washing, some form of colorimetric device seems to be essential. It would also be of value in determining the end-point, if complete cleanness or agreement with blanks, becomes the accepted standard of judgment. Members of the Committee have used the Ives tintometer, the Taylor photometer as modified by Rhodes, and other instruments, in judging the specimens of cloth. At present, no form of apparatus has been adopted.

From the foregoing it will be clear that the problem is far from solved. It is felt however, that progress has been made and that further cooperative effort may lead to valuable results.

Margarine Legislation Hearings in Washington

Dairy Interests Continue Desperate Attacks Upon a Staple Food Product Through Attempted Political Measures

A RECENT ruling of the Bureau of Internal Revenue, permitting the use of properly refined and deodorized palm oil in the manufacture of margarine has caused the introduction in Congress of a variety of measures designed to make the manufacture and sale of margarines even more difficult in the future than in the past. The proposals range from those contained in measures designed to prohibit the purchase of margarine by any branch of the Federal Government to a proposal to place a prohibitive tax upon any margarine manufactured in whole or in part of coconut oil or any other imported oil. The most important measure proposes to apply the present tax of ten cents per pound, (which is now applicable only to artificially colored margarines), to all yellow margarine, whether the yellow color is the natural color of the ingredients, or is produced by artificial means.

Hearings on this measure were held in Washington during the latter part of January, before the House Committee on Agriculture. The proponents of the bill appeared first, and representatives of the dairy industry most strongly urged this proposal to hamper those whom they regard as competitors.

The principle of applying the ten-cent tax to all yellow margarine regardless of the source of the color was endorsed in letters to the committee from Secretary of Agriculture Hyde, who declared the use of colored oils to escape the tax to be a nullification of the oleomargarine act, and from Under-secretary of the Treasury Mills, who expressed the opinion that such a law would be easier to enforce than the present law.

Charles W. Holman, Secretary of the National Cooperative Milk Producers' Federation, advocated the bill on two grounds, first, to protect the dairy industry and consumers against possibility of fraud, and second, to protect the domestic butter and vegetable oils industries from increased use of a product made largely from imported oils. Dr. E. B. McCollum, of Johns Hopkins University appeared as a nutrition expert for the dairy interests and stated that vitamin A, the outstanding vitamin in butter, is completely lacking in all white vegetable oils and in most yellow oils. He stated that all margarines are inferior to even poor grades of butter, in that they lack vitamin A.

Defense of the margarine industry was opened by Dr. J. S. Abbott and W. F. Steele of the Institute of Margarine Manufacturers, and G. G. Grant of Durkee's Famous Foods, Inc. They declared that palm oil is a valuable food product and that as at present produced it is a useful constituent of margarine for other purposes than imparting color. They denied that margarine is colored for purposes of fraud and declared that the public should be permitted to buy any food product free of tax, if properly labeled. The refining of oils for food uses was described to the committee and palm oil was declared to be as natural as any other edible oil and therefore exempt from the tax on artificial coloring matter.

A further witness against the proposed legislation was B. F. Pearsall, of the Pearsall Butter Company, who ridiculed the claim that the sale of naturally yellow-colored margarine in recent months had lowered the price of butter, citing statistics to show that butter price drops are seasonal.

Opposition to the proposed bill was also voiced by labor interests and by the Housewives Alliance of Baltimore. Henry F. Breunig, of the Baltimore Federation of Labor, opposed placing taxes on this or other food products and statements were filed from other labor organizations. Walter F. Eddy, Director of the Good Housekeeping Bureau of Foods, stated that palm oil does impart vitamins to

(*Turn to page 77*)

Impressions of the European Soap Industry*

Describing Many Varieties of Plant and Manufacturing Methods Encountered on a Tour Through Western Europe

By Archibald Campbell

IF WE might classify American soap plants as medieval and modern, then on the same basis of nomenclature we should classify European Soap plants as ancient, medieval, and modern. In the ruins of Pompeii, I was shown the remains of a soap factory that flourished some 600 years B. C. This surely was ancient. However in those early days, they understood how to boil soap as is evidenced by the lead and copper vessels equipped with lead piping for heating and circulating purposes. Some of the soap is still encrusted on these vessels and although hard and fossilized compares rather favorably to the casual observer to some of the highly-builded American soaps after they have reposed on the retailer's shelf for several months. When I was more actively engaged in the manufacture of soap, I sometimes wondered how our competitors were able to hold so much builder in their soaps; but after visiting this plant at Pompeii, I am inclined to the belief that some of those wily competitors must have succeeded in getting a sample of this soap and gained the secret of building soaps à la Pompeii.

Although Pompeii was the only truly ancient plant I visited in Europe, nevertheless, I must confess I visited others that could easily be classed, if not ancient, at least pre-medieval. They were one step worse than the worst I ever saw in the United States and I considered those in the medieval class. Plants that had been in the same family for several generations, and catered to a certain local patronage, being perfectly content to continue along certain established lines of production. In some of these plants, the equipment was meager and antiquated. They were unsanitary and unsafe. Many workmen going about their duties barefooted, even around the soap kettles. The processes were laborious, inefficient and uncontrolled. As an illustration I saw soap that had stood on drying racks for over three months to effect the proper drying. Needless to say this soap had a real antique appearance.

These plants were the exception however, rather than the rule. By far the greater number of plants visited by me in France, Italy, Germany, and Great Britain compared favorably with the general run of soap plants in the United States; especially was this true when the concern enjoyed a national or international business. In most of such plants, the equipment consisted of an assortment of old antiquated machines and others of more modern design together with still others of a strictly up-to-date model. This was particularly noticeable in the plants in Great Britain where they seem to be very slow to discard obsolete equipment and replace it with the latest and most efficient new models. They cannot see the expediency of discarding a machine until it is worn out, regardless of its inefficiency. While this is due in part to the low cost of labor, nevertheless these same firms are extremely anxious in purchasing new equipment to secure the latest and most efficient models. It seems a very part of their nature to hang on to the old machines as long as they will operate. The plants I visited in Germany seemed much more up-to-date in this respect; and as labor was just as cheap if not cheaper than in Great Britain, I can only explain it as some inherent national trait; as the concerns in both instances seemed equally alert, progressive, and successful.

AS THE per-capita consumption of soap in France and Italy is exceedingly small the outputs of most of the plants in these countries are comparatively limited and unless the firm does an international business, there is not the incentive to grow and develop. The other influence that is making itself felt in this respect is foreign ownership and control of

*Read before the American Oil Chemists Society, Soap Section Meeting, Chicago, Nov. 1930.

local concerns. This control tends to introduce modern methods and ideas as well as up-to-date equipment. In general, the plants under French control and management use French built equipment. In some instances, this compares favorably with that of American or German make, but in automatic labor saving equipment the American and German machines excel. The plants in Germany are mostly equipped with German built machines. These compare very favorably with the same type of American equipment, in speed, cost, and character of workmanship. In Great Britain and in plants on the Continent, controlled by British or American capital most of the equipment is American designed and built machine.

The plant of Henkel & Co., Duesseldorf, Germany, impressed me more favorably than any soap plant I visited in Europe, and even in the United States as well. This is a moderate sized plant, devoted to the manufacture of cleansers and washing powders. The plant was strictly up-to-date and modern throughout. A pulp mill was operated in connection with the soap plant to produce the pulp and paper used in containers for packaging their finished products. An oilmill for crushing, pressing, and extracting oils, from seed, was also operated in connection with the plant. They produced their own caustic soda together with silicate of soda. For decomposing and splitting fats for the recovery of glycerine, they used three of the most up-to-date methods and for the distillation of fatty acids and glycerine, they operated under an extremely high vacuum. The soap powders were produced by the spray process and packaged on automatic machines that were the last work in completeness and efficiency. The entire plant was clean, sanitary, well-lighted, and ventilated. The packing rooms were tile-floored and tile-wainscoted, and equipped with dust collecting systems. The offices were beautifully finished in marble and bronze, and in a garden at the entrance was an artistic bronze memorial to those of their staff who had made the supreme sacrifice in the late war. The entire plant was under strict chemical and mechanical control with a complete cost system covering each step of the process. It came as near the ideal as I have ever seen in a soap plant.

THE Port Sunlight plant of The Lever Brothers Co. is the most outstanding soap plant in Great Britain. It is so immense that it is very difficult to form a clear impression of it on the first visit through it. The plant is well lighted and working conditions are very good throughout. The thousands of visitors are conducted through the plant on runways erected above the working floors, where they are safe from harm and command an unobstructed view of the manufacturing operations below. The layout, equipment, and processing compare very favorably with the largest modern plants in the United States. The welfare work in the plant, also in the model village of Port Sunlight, seems very well organized and carried on in a very complete and thorough manner, including art galleries, theatres, schools, churches, swimming pools, athletic fields, libraries, savingbanks, playgrounds and everything that makes for a higher plane of living. It is probably, up to the present time, the nearest approach to the realization of a dream of the head of a great industrial institution for the welfare and social betterment of his employees.

TOILET soaps in France and Italy are made largely from olive oil as a base; many are made wholly of this material. This does not apply to soaps manufactured by concerns controlled by British or American capital. These firms maintain their regular formulae for their standard, advertised brands. Toilet soaps in Great Britain resemble in composition and appearance those of the United States. The soaps containing high percentages of olive oil are soft and require special drying treatment to render them merchantable. On account of cheapness of perfumes and labor, European soap manufacturers are able to turn out more highly scented and more expensively wrapped and packaged soaps than could be turned out and sold at an equal price in the United States.

LAUNDRY soaps in Europe are mostly pure soaps, containing little or no alkaline builders. Soap powders, washing powders, and cleansers, likewise have a higher percentage of soap than the corresponding American product. These pure soaps lend themselves to the artificial system of cooling and slabbing which is quite extensively used abroad. The fats used in these soaps are largely tallow, grease, palm oils, rosin, hydrogenated marine oils, with comparatively small amounts of nut oils. The highly builded soaps containing a high percentage of nut oils, so common in American markets, are practically unknown in Europe. Soft-soaps so commonly used in past years in Europe seem to be on the wane and are being replaced by bar soap and powders. The tendency in Europe as in America seems to be away from soft soaps and bar soaps to chips, flakes, and powders, sold in bulk or packages.

Notes of the Industry

Vegetable Oils Tariff

The United States Tariff Commission has issued notices, pursuant to Section 332(g) of the Tariff Act of 1930, that a public hearing will be held at the office of the United States Tariff Commission in Washington, D. C., at 10:00 o'clock a.m. on the 17th day of February, 1931, at which time all parties interested will be given opportunity to be present, to produce evidence, and to be heard with regard to the investigation instituted by the Commission for the purpose of ascertaining information concerning the cost of production and transportation to the principal consuming markets of the United States on the following articles: Coconut oil and copra from the Philippine Islands and from other principal producing centers, palm oil and palm kernel oil, whale oil, rapeseed oil, perilla oil and sesame oil.

This Public Hearing will be undoubtedly of momentous interest to all American producers and refiners of edible and inedible oils and fats, animal as well as vegetable, and likewise to all soapmakers. The present low prices of all oils and fats will undoubtedly cause interest to be centered upon the effect of the existing tariffs upon those prices and the possible effects of revisions of duties upward or downward upon certain oils.

The hearing will also be attended by representatives of certain outside interests who will take the opportunity of recommending higher tariffs on imported oils, not for the protection of their own industries, but for the actual exclusion of certain imported oils, if possible. The oils which will be the targets for such effort are not produced in the United States and cannot be produced here, so that those who are interested in their importation and in the manufacture of their developed products will without doubt be present at the hearing to combat the efforts of those who would further prohibitive duties.

Stocks of crude cottonseed oil on hand December 31, 1930, in United States, totaled 114,248,422 pounds as against 115,884,530 at the close of the previous year. Stocks of refined oil were 428,609,270 on December 31, 1930, as against 425,459,221 on the same date in 1929.

Mayonnaise Committees

President W. R. McKeldin has announced the appointment of the various committees of the Mayonnaise Manufacturers Association. The chairman of the committees for the current year are as follows: Alvertising, E. J. Bannvart; Container Simplifications, H. S. Wade; Cost Finding, Ellis R. Meaker; Legislative, B. S. Pearsall; Membership, C. P. McCormick; New Uses, Anna Schlorer Smith; Publicity, John T. Ogden; Standards and Research, Dan Gray; Traffic, V. L. Garbesi; Trade Practice, Frank Honicker; Research Fellowship, John Glassford.

Henry W. Galley, who was general sales manager for the American Linseed Company several years ago, has become manager of the oils division of the Staley Sales Corporation, Decatur, Ill. The Staley company manufactures various products from corn and soybeans.

Batten, Barten, Durstine & Osborn, New York, advertising agents, recently installed a kitchen for use in making tests and preparing advertising copy for its clients. Most of the equipment and materials used in furnishing and stocking the kitchen were secured from clients of the agency.

The Federal Trade Commission has dismissed a complaint charging the Blanton Company, St. Louis, with unfair methods of competition in the sale of margarine.

The Annual Convention of the National Cottonseed Products Association will be held at the Roosevelt Hotel, New Orleans, Louisiana, on May 18, 19 and 20. The Rules Committee of the Association will meet at the same place on the 15th and 16th of May.

British imports of linseed oil increased by 14,561 tons in the first eleven months of 1930, and exports decreased by 3,970 tons. This condition was attributable to the fact that the Margarine Union, which controls the larger part of the crushing of flaxseed in the United Kingdom, has found it more economical to produce linseed oil in its plants in Germany and the Netherlands.

Procter Buys Baltimore Mill

The Procter and Gamble Company have announced the completion of negotiations for the purchase of the copra crushing mill of the Oil Seeds Crushing Company, in the Canton district of Baltimore. The plant of the Oil Seeds Crushing Company is one of the finest and best equipped copra mills in the country, having been built in 1920 at a cost exceeding a million dollars by the Coconut Products Corporation.

Although the equipment installed in the plant was of the latest modern design, the early years were marked by part-time operation only, and by several reorganizations of the company's finances, due chiefly to unfavorable market conditions and to alleged inexperience of the promoters of the business. In the hands of the Procter and Gamble organization, this plant will undoubtedly become a substantial addition to Baltimore's industries.

This mill will prove a valuable unit of the Procter and Gamble Company, as it will provide a source for coconut oil for the new soap plant of the company recently completed at Baltimore. The company officials announce that the new copra mill will be operated at capacity, giving employment to more than 100 men.

A measure has been introduced in Congress by Representative Aldrich, of Rhode Island, to postpone for twenty-four months from its passage, the effective date of the amendment to the oleomargarine act which places the oleomargarine tax upon so-called cooking compounds which are so manufactured as to bear a certain resemblance to butter in color and texture, though not in flavor. The amendment was enacted last year and is scheduled to take effect July 1, 1931.

The Mexican sesame crop is estimated to be only about 50% of normal this year. Production in 1929 amounted to 10,900 metric tons.

Preliminary indications of the cod liver oil situation in Norway indicate a fairly promising season, although fishing for cod does not start in earnest until after the beginning of January.

The olive oil production of Greece for 1930-31 is estimated to amount to 26,445,700 gallons. The quality of the oil is expected to be excellent on account of the good condition of the olives in most districts. Two or three districts only were attacked by the dacus borer.

Total shipments or deliveries of oleomargarine and other butter substitutes in 1929 by manufacturers in the United States amounted to 310,622,331 pounds, valued at $51,578,644 at factory prices. This was an increase of 5.6 percent in quantity and a decrease of three-tenths of one percent in value, as compared with the figures for 1927 the last previous census year, when shipments were 294,066,722 pounds, valued at $51,751,757.

The following table contains comparisons of the oleomargarine and other butter substitutes production and values by kind and quantity for 1927 and 1929:—

	1929	1927	Percent increase
Oleomargarine and other butter substitutes made in all industries—			
Total pounds	310,622,331	294,066,722	5.6
Total value	$51,578,664	$51,751,757	*0.3
Made in "Oleomargarin and other butter substitutes" industry—			
Pounds	170,804,526	180,103,026	*5.2
Value	$30,113,829	$33,024,819	*8.8
Made in the meat-packing industry—			
Pounds	108,173,643	86,651,746	24.8
Value	$16,521,785	$14,501,799	13.9
Made as secondary products in other industries—			
Pounds	31,644,162	27,311,950	15.9
Value	$4,943,050	$4,225,139	17.0
† Reported according to materials used (exclusive of production in the meat-packing industry)—			
Composed of a mixture of animal and vegetable oils and fats—			
Pounds	71,291,565	72,933,077	*2.3
Value	$14,046,704	$15,080,480	*6.9
Composed solely of vegetable oils and fats—			
Pounds	131,157,123	134,481,899	*2.5
Value	$21,010,175	$22,169,478	*5.2

* Decrease.

† Oleomargarine made in the meat-packing industry was not reported according to materials used.

A new list of organic chemicals that it has manufactured or purified has been issued by the Eastman Kodak Company, Rochester, New York. The new list contains, in regular classification, 116 items not previously cataloged by the company and thirteen additional items added too late for classification. This list will undoubtedly prove of the greatest value to research and control laboratories.

Vice-Consul Williams in Nueva Laredo, Mexico, reports that a lard refinery owned and operated by an American packer is now in operation in that city. The plant has a capacity of 60,000 pounds per day and an estimated annual output of 5,000 tons. The lard will be packed in cans manufactured at the refinery.

Armour & Co., Chicago, reports an income of $21,388,104 for the year ended November 1, before deducting for depreciation and interest requirements, this comparing with $29,383,209 for the previous year. After deductions and before dividends, the earnings total $4,741,027, as against $9,810,518 in the previous year.

At the 13th Exposition of Chemical Industries which will be held in Grand Central Palace, New York, May 4 to 9, there will be a special section of the exhibit devoted to the container industry. Numerous types of containers and apparatus for filling, weighing, measuring, sealing, labeling, packaging and handling will be demonstrated.

Armour & Co. has taken out $35,000,000 additional group insurance, the cost of which it will share with its employees, bringing its total coverage up to $100,000,000.

Procter & Gamble Co. paid a regular quarterly dividend of $1.25 on its 5% preferred stock on December 15 to stock of record November 25.

Procter & Gamble Co. recently opened two new district offices. The Cleveland office will be in charge of John Z. Heizer, formerly of Cincinnati. E. Z. Zimmerman will manage the Omaha office.

Dr. George W. Hoover, consultant on foods, drugs, insecticides, formulas, labels and application of State and Federal Laws, has recently moved his office to Shoreham Building, Washington, D. C.

According to the U. S. Census of Manufacturers the total production of soda ash in United States during 1929 totaled 2,682,216 tons. The figure for silicate of soda was 591,345 tons. Total caustic soda production, exclusive of the material made and consumed in the wood pulp and textile industries amounted to 758,800 tons.

The first annual "Fueling Party" of the Westchester Oil Trade Association was held at the Hotel Astor, January 31. Dinner was followed by an extensive program of entertainment. M. J. Gilday was chairman of the committee in charge of the affair.

A recent act of the Australian Parliament provides for the payment of bounties on the production of flax and linseed in Australia.

Brucine alkaloid has been added to the list of permissible denaturants for vegetable oils, duty free, when inedible, by order of the Bureau of Customs. The material is to be used in the proportion of one-half ounce to the gallon of olive, palm-kernel, rapeseed, sunflower or sesame oil.

A recent ruling of the Commissioner of Customs declares that castor oil meal, because its poisonous properties make it unfit for use as a foodstuff, is classifiable as a fertilizer and may be imported free of duty. The Bureau of Customs is investigating the dutiability of ground cocoa shells and cocoa residue, a question having been raised by the importation of cocoa residue mixed with ground cocoa leaves.

T. George Lee has been elected President of Armour and Company succeeding the late F. Edson White. Mr. Lee has been in the service of Armour and Company for more than thirty-five years, starting as a stenographer in the beef department and advancing steadily to become Vice-president in charge of that department in 1926.

According to figures reported to the Bureau of Internal Revenue by margarin manufacturers, production in December, 1930, compares with December, 1929, as follows:

	Pounds 1930	Pounds 1929
Production of uncolored margarine	*28,066,303	31,226,440
Production of colored margarine	†902,489	1,656,465
Total production	28,968,792	32,882,905
Percent decrease	12%	

*Of this amount 16,577 pounds were reworked.
†2,004 pounds reworked.

Balfour, Williamson & Co., and Balfour, Guthrie & Co., Ltd., importers and exporters with offices in New York and on the Pacific Coast and with agencies and representatives in various foreign countries have merged. The merged firms will continue business under the name of Balfour, Guthrie & Co., Ltd.

The Colonial government authorities of Trinidad, British West Indies, have recently approved a new tariff schedule which provides for British preferential rates of 50c per 100 pounds on lard as contrasted with a general rate which applies to the imports from the United States of $2.00 per 100 pounds.

Textile Oils

(*From P. 57*)

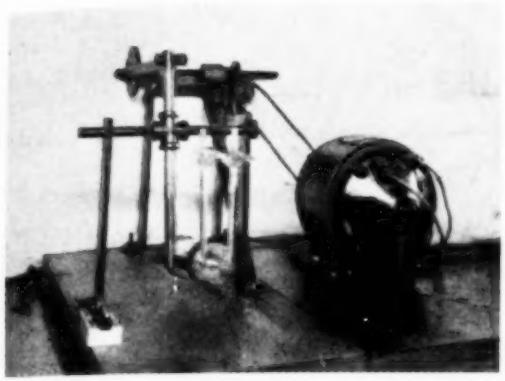


Fig. 12

bulb from slipping. The rocker arm is 14 mm. long from axis of shaft to the center of the bulb. The upper part of the rocker arm, from axis of shaft to the pivot of the rocker beam is 7.5 cm. The rocker beam is given a transverse motion by means of a rotating wheel, about which it travels in a circle of 36 mm. diameter at its point of attachment. The speed reduction to 140 r.p.m. on the driving pin is accomplished through a worm gear. Although the load is light, a substantial motor is recommended as a provision for constant speed. A ⅛ to ¼ h.p. motor, induction type, is preferable. The mechanical relations of the shaker are shown in the diagram of *Figure* 14. When in operation, the bulb is immersed in an oil bath (*Figure* 13) which is electrically heated by a coil of resistance wire along one side and at the bottom of the oil container. A glass plate cut to fit the bottom of the pan prevents the oil from shorting. The temperature of the oil bath is regulated by suitable resistances. A medium or heavy motor oil serves very well for the bath. It would be advisable to construct the pan with ends about three inches higher than the sides (not shown in the photographs) to reduce splashing.

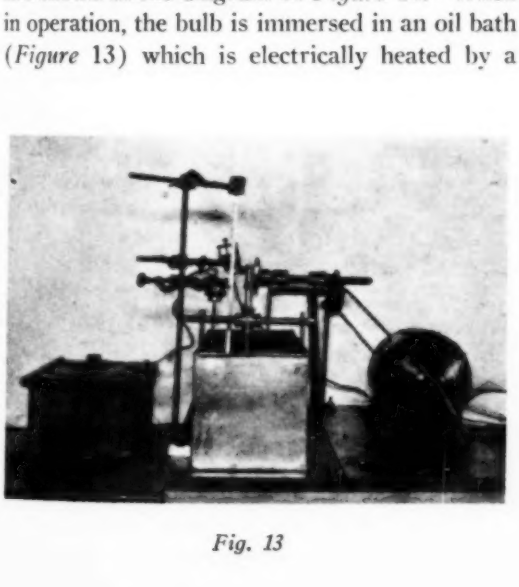
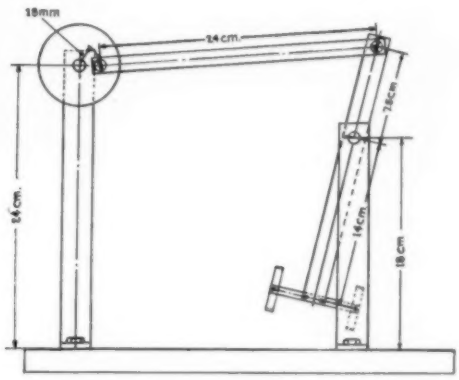


Fig. 13



LEVER RATIOS OF SHAKER

Fig. 14

(*To be continued*)

Margarine Legislation

(*From P. 65*)

margarine. N. F. O'Dea, of the Baltimore Butterine Company, testified that dairy interests had opposed the sale of margarine before foreign oils were used.

Mr. Pearsall testified further that, from records of the Department of Agriculture, there were 113 judgments against creameries for adulteration of butter in 1929 and 144 in 1930, whereas in ten years the only judgment against margarine was one instance of packages being overweight, this being a violation of the internal revenue laws.

The Neuhoff Packing Company, Nashville, and its subsidiaries, the Nashville Cold Storage Company and the White Provision Company, Atlanta, have been purchased by Swift & Co., Chicago, for about $3,000,000 plus inventories at current prices.

OIL & FAT INDUSTRIES

The Editor's Page

A Service Opportunity

THE National Cottonseed Products Association, embracing in its membership the majority of the cottonseed oil mills of the country, is at present confronted with the greatest opportunity of its history.

At great expenditure of time and effort, the association has perfected a survey of costs within its industry, which survey has clearly demonstrated that the average profit, as well as the great majority of individual profits of mills, is so astoundingly low that the business of cottonseed crushing presents a most uninviting field to capital. The survey has shown further, that a large percentage of the mills are being operated at substantial losses, instead of any profits whatever.

This covers the economic side of the picture. From the practical operating standpoint, the survey has clearly demonstrated that the reason for this sad economic situation is to be found in a heavy surplus of milling capacity over the amount that is required to handle the seed from the country's largest possible cotton crop. The immediate plea of all the oil millers, whether members of the National Association or not, is: "help us to greater profit through better balancing of facilities with our visible supply of raw material."

There appears as a matter of course, an undertone of sentiment which would approve the elimination of about one-half the existing mills, to the end that those remaining can then enjoy satisfactory operating profits. Such a solution is entirely without the bounds of practicality. Who is to select the mills to be abandoned? Who is to reimburse their owners for their investment, and assuming that a group of millers could be organized to purchase and scrap a large number of existing competitive mills, what effective measures could be taken to prevent the owners of the scrapped mills from promptly building more efficient units to enter the new competition?

For genuine help in this situation, the cottonseed crushers must read the lesson long since learned by their European competitors, that an oil mill is and should be an oil mill, not a cottonseed mill, a copra mill or a soybean mill.

To prove its right to leadership in the oil mill industry of this country, the National Cottonseed Products Association now has this golden opportunity, to initiate a campaign of education designed to show its members how to keep their presses running twenty-four hours a day, three hundred days a year, if not on cottonseed, then on peanuts, or soybeans, or copra, or palmkernels, or sesame, or other oil-bearing seeds or nuts. The problems involved are varied, but essentially simple. Physical revision of plants is the least. Education of the Southern farmer to plant soybeans would have a part in the program, as would establishment of satisfactory facilities for the import of foreign seeds through various Southern ports. Education of the banker is another essential, in order that he shall cooperate in the matter of foreign credits.

All the necessary steps are subject to accomplishment. Will the Association undertake this effort which is so vital to its members' welfare?

From Him Who Hath Not . . .

FROM the inception of our country, taxes on necessary articles of food, as distinguished from luxuries, have been considered as opposed to the basic principles of our government, by lawmakers as well as by the people at large. One of the "oppressions" which led the Colonies to rebel against King George's government was a tax on tea, if our historians have been accurate in their recordings.

This order of things has now been reversed by our late, but little lamented Congress. Actuated by mixed, but chiefly political, motives, our National solons have voted to place a confiscatory tax upon the manufacture of a clean, healthy food product, one which all authorities agree serves a definite purpose in our economy.

If the price-differential between butter and margarine acts only as a curb upon selfish interests which seek to maintain the price of the former commodity at a profiteering level, margarine has justified its existence.

The issue of color which has been used so successfully against margarine for many years is only more or less of a smoke screen. Butter makers, in creameries, in dairies, and on farms, have used artificial coloring matter in their product for generations. Should they not be taxed as imitators, quite as much as the margarine manufacturer.

No one will attempt to dispute the fact that the major part of the poverty still to be found in our wealthy nation is found among the working classes in the cities, rather than in the rural districts.

It is these workers, struggling to meet the constantly rising cost of food, who are denied the right to purchase a clean, nutritious food product at a reasonable price by this latest caprice of our lawmakers.

Archibald Campbell, Consulting Engineer, of Cincinnati, spent a few days in New York during the latter part of February.

The feed and chopping mill of the Dominion Linseed Company, Owen Sound, Ontario, was recently destroyed by fire, with a loss of about $300,000., fully covered by insurance.

A bill proposing agricultural product embargoes against imports was recently proposed by Representative Burtness of North Dakota. Edible palm oil butter and margarine and mixed feeds containing oilcake were among the products specifically referred to as subjects of the proposed embargo.

Position Wanted: Capable executive, qualified by training and experience as General Manager or Sales Manager of edible oil refinery, compound or margarine business. Experience covers general management in such lines, including all edible oil specialties, coconut butters, salad oil, mayonnaise, margarine. Address Box A12, c/o *Oil & Fat Industries,* 136 Liberty Street, New York, N. Y.

A dust explosion in the flaxseed elevator of Spencer Kellogg and Sons, Inc., at Buffalo on February 18, caused damage exceeding $15,000.

Shortening and Oil Prices

Prices of shortening and salad and cooking oils on Thursday, February 26, 1931, based on sales made by member companies of the Shortening and Oil Division of the National Cottonseed Products Association, were as follows:

Shortening

	Per lb.
North and Northeast:	
Carlots, 26,000 lbs.	@10
3,500 lbs. and up	@10¼
Less than 3,500 lbs.	@10½
Southeast:	
3,500 lbs.	@ 9¾
Less than 3,500 lbs.	@10¼
Southwest:	
Carlots, 26,000 lbs.	@ 9¾
10,000 lbs. and up	@ 9¾
Less than 10,000 lbs.	@10¼

Salad Oil

North and Northeast:	
Carlots, 26,000 lbs.	@10
5 bbls. and up	@10¼
1 to 4 bbls.	@10½
South:	
Carlots, 26,000 lbs.	@ 9¾
Less than carlots	@10

Cooking Oil—White

⅛c per lb. less than salad oil.

Cooking Oil—Yellow

¼c per lb. less than salad oil.

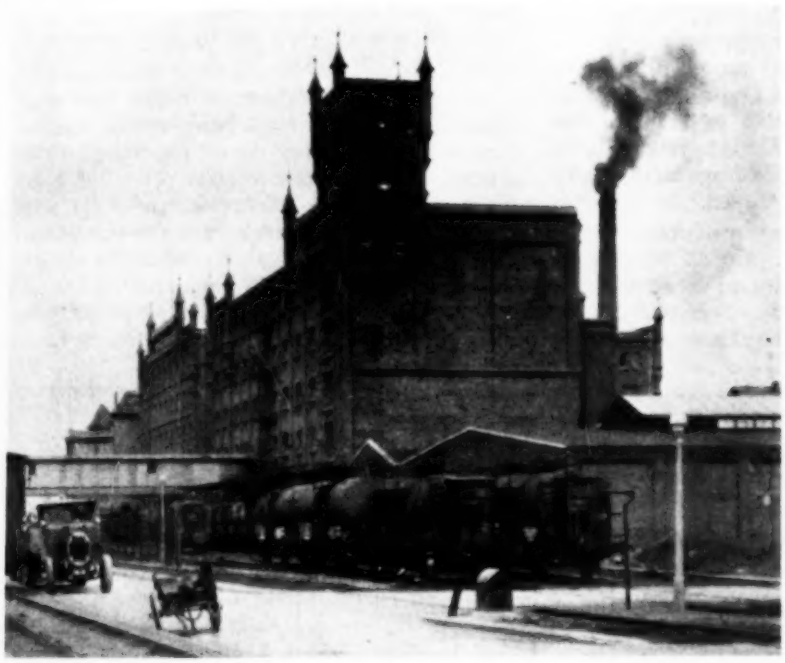
Armour & Co. have reported net earnings of $4,741,027 for the fiscal year ended November 1, before dividends, compared with $9,810,518 net in the previous fiscal year. After payment of preferred dividends out of net income and surplus there remained a surplus of $43,078,092 as of November 2, 1930.

Whaling companies are beginning to experience some misgivings as to the future of the industry. At the annual meeting in London of one of the largest companies, in explaining why the final dividend of the year was not paid, the directors made reference to the present low levels at which whale oil is selling in the open market and acknowledged that the recent expansion in production had been too rapid for consumptive requirements.

The Oil Mill Industry In Modern Germany

A Current Review of the Vegetable Oil Industry of the Republic, Including Comparison with Prewar Conditions

By Coke S. Rice *
Vice Consul at Hamburg



Typical large German oil mill and refinery located at Bremen, operating chiefly on peanut oil

IT IS generally supposed that oil milling in Germany started some 2,000 years ago, when the Romans invaded the country and taught domestic oil milling. Today, it is in first place among other industries in the value of raw materials imported. In 1929 the value of oil seeds and oil fruits imported was over $204,852,000, with cotton imports second with a value of $185,081,400, with wool third with a value of $143,634,600. Add to this the value of the oils and fats imported and the industry reaches a tremendous scale.

The German oil milling industry, together with factories for the refining of imported oils, comprises a total of 60 concerns, employing about 14,000 workers. Of these factories, the largest is located in Harburg. This concern, the largest in Europe, together with its branch factories has plants occupying 331,000 square meters. The plant in Harburg has 35 boilers, driving eleven steam engines and three steam turbines with a total of 10,000 horsepower. Equipped with the latest presses and other machinery, these works have a daily capacity of more than 2,000 metric tons of seed, and can handle 350 tons of crude oil a day in the refining plants, while one of the plants, situated at Brake in Oldenburg, which also handles fish and whale oils, can harden 450 tons a day. The plants in Harburg and Brake are situated so that steamers and railroad cars can discharge their cargoes direct into warehouses and silos. The Harburg plants have a total

* *Report to Foodstuffs Division, Dept. of Commerce. Published by Special Permission.*

storage capacity of 80,000 metric tons of seed, with storage tanks of 25,000 tons capacity.

Other large mills in Germany are located in Hamburg, Bremen, and Stettin, other factories being located in southern Germany along the Rhine; the products of the latter being for home consumption, the former with the mills in Harburg and Brake, supplying the exports. The five main oils—peanut oil, linseed oil, palm kernel oil, coconut oil, and soy bean oil—comprise about 95 percent of the total production of all plants. Of the production costs, an average of between 85 and 90 percent goes for raw materials, while wages fluctuate between 2.5 and 5.5 percent of the total costs.

Pre-war and Postwar Developments

PRIOR to the outbreak of the war Germany had a commanding lead among European nations in the production of oil products. During the war it was impossible to maintain this position, and at its close Germany was faced with the problems of rebuilding an industry which had been almost destroyed.

The following oil bearing products, foreign to Germany, are discussed: Copra, cottonseed, palm kernels, peanuts, sesame, seed, and soy beans, as well as castor, olive, palm, fish, seal and whale and wood or tung. Other oleaginous products are omitted, as no statistics are available, and also as they are of relatively minor importance. Domestic production of the various oils is arrived at by using an average oil yield for each product, as furnished by a local mill. Quantities are shown in metric tons of 2,204.6 pounds. Prices are quoted c.i.f. Hamburg. Import duties listed are under most-favored-nation clauses.

Copra

COPRA, the dried fruit of the coconut, has ever played an important role in the oil industry in Germany. The quantity of oil produced ranks third in the list of oils under discussion. The Netherland Indies furnish the greater part of copra imported, the rest being fairly equally divided among the other copra-producing countries.

Coconut oil, product of copra, has many uses, the most important being in the manufacture of soap and for use in the margarine industry. With the exception of 1920, when there was a decided decrease, and 1929, when there was a rather large increase, the production has not changed greatly, while the quantity imported has increased to almost 2,000 percent over 1913 and almost 600 percent over 1926. This increase in imports was caused

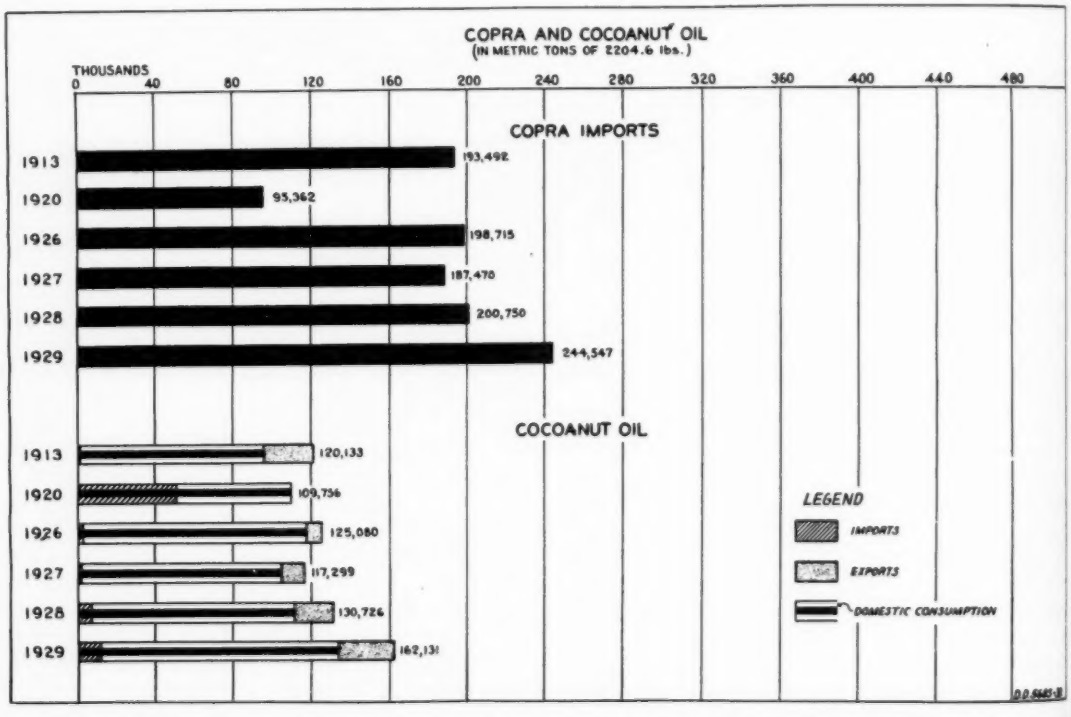


Chart depicting German imports of copra, also imports, exports and domestic consumption of coconut oil, in selected years from 1913 to 1929

chiefly by the reduction of the duty formerly imposed, the present tariff being 1.25 marks per 100 kilos ($0.13½ per 100 pounds) for edible oil; inedible, free.

During the past four years exports have steadily increased, caused chiefly by the fact that the largest mill controlled by Dutch interests in Germany has branch margarine factories in other countries and supplies these factories with oil.

The increase in the percentage of exports of coconut oil is about in line with the increase in the percentage of palm kernel oil. As these two oils are similar in physical properties, there is little likelihood of there being much of a change in favor of one or the other.

The quantities consumed locally have not varied much during the last four years, with the exception of 1929. However, there has been a decided increase over 1913, due to the increase in sales for human consumption. In 1929, 76.8 percent of total local sales was for human consumption.

Coconut cake is used as a feed for cattle, but is not as popular as some other cakes. However, quite a large amount is imported, as judged from the statistics for 1929 when 110,27 metric tons were imported as against 4,963 tons exported, with the Philippines and the Netherland Indies supplying the most of the imports and Denmark and the Netherlands taking most of the exports.

Price movements affecting coconut oil for the years 1926 to 1929, inclusive, and the first eight months of 1930, show that while ordinarily there is a difference of about $1.16 per 100 kilos in favor of coconut oil over palm kernel oil, the past year and so far this year has seen this difference almost disappear and for the first time in the history of the vegetable oil industry, the price of coconut oil dropped below the price of palm kernel oil. The difference in the price of the two oils as of August 31, 1930, was small.

Cottonseed

PRIOR to the war cottonseed played an important part in the vegetable oil industry in Germany. Since that time, it has lost considerable ground, being replaced by other oil-bearing seeds until at present it ranks last in importance in the list of oil-bearing vegetable products imported into Germany. A big factor in the reduction of imports is that the residue, cottonseed cake, is not so popular for cattle food as other cakes.

Egypt furnishes the largest part of the imports into Germany. Imports from the United States are light, owing to the high price in comparison with other countries. There is slight chance that the amount of cottonseed imported from the United States will increase, nor is there much likelihood that total imports will increase appreciably. Cottonseed as a factor in the vegetable oil industry in Germany has definitely lost ground, which will not be regained, at least for many years to come.

Since there is little demand for cottonseed cake and meal, the domestic production of oil is very low, most of it being imported. But imports are handicapped in that there is a rather heavy duty imposed. For oil in barrels this duty is 2.50 reichsmarks per 100 kilos ($0.27 per 100 pounds) in other containers 20-21 percent. The domestic production has steadily decreased, the quantity being less than 4 percent of the production in 1913 and 24 percent in 1926. Imports have likewise decreased, the total in 1929 being 38 percent of the total in 1913. During the past four years, imports have remained fairly steady, with the exception of 1927.

Great Britain and Egypt furnish the greater part of the imports, with the Netherlands and the United States participating about equally. Recently, Russia has been supplying part of the imports, surpassing both the Netherlands and the United States, and bids fair to be a serious competitor in the future. While America is the largest producer of cottonseed products, owing to the high prices for the American product, there is little chance that sales in the German market can be increased to any extent. Exports are of little consequence being but 414 metric tons last year. The Netherlands and Denmark were the chief buyers.

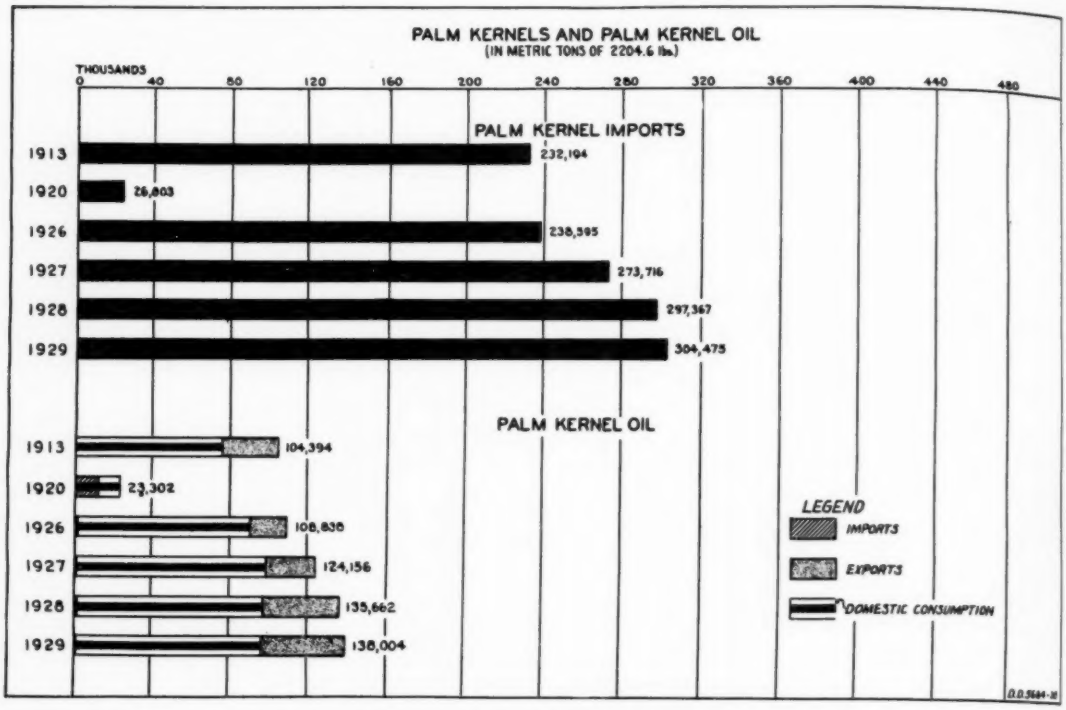
Palm Kernels

IN THE pre-war period, Germany led in the quantity of palm kernels imported. During the war the crushing industry was transferred to Great Britain, where in order to retain the industry a system of preferential export duties on palm kernels was instituted. However, this was repealed in 1922, which accounts in a large measure for the re-establishment of the industry in Germany. By 1928 Germany had surpassed pre-war figures, while imports into Great Britain had suffered a substantial decrease.

The following table shows the imports of palm kernels into Great Britain, France, and Germany for the years 1913, 1920, and 1928.

IMPORTS OF PALM KERNEL BY GREAT BRITAIN, FRANCE, AND GERMANY
for the years 1913, 1920 and 1928
(metric tons)

	1913	1920	1928
Great Britain	36,012	286,526	159,052
France	2,939	46,092	12,750
Germany	232,194	26,803	297,367



Graphic representation of German trade in palm kernels and palm kernel oil in typical years between 1913 and 1929

Imports of palm kernel oil are of very little importance at present, as production is able to take care of consumption and at the same time provide for exports. The duty on this oil is 1.25 marks per 100 kilos ($0.13½ per 100 pounds) for edible grade; inedible oil is free. In contrast to the decrease in imports, exports have steadily increased. The quantity exported in 1929 was approximately 50 percent greater than in 1913. Inasmuch as local consumption remains fairly equal from year to year, the increase in production will undoubtedly be exported.

In line with the decreased imports of palm kernels into Great Britain, exports of oil from Germany to that country have increased. This is additional evidence of the transference of the industry from England to Germany. Whereas, the United States in the years immediately followed the war purchased from England, in recent years it has turned to the German market, purchasing nearly four times as much in 1929 as in 1926.

During the past four years, with the exception of 1927, when there was a decrease in the consumption of coconut oil, the home consumption remained fairly steady. In line with the continued reduction in the price of coconut oil, the price of palm kernel oil has continued to fall. During the first five months of 1930, prices fluctuated markedly. Since June they have dropped sharply and record low levels have been established. Present market reports indicate little likelihood of much improvement in the near future.

(To be continued)

The cultivation of a new variety of late sesame seed in place of peanuts has resulted in a small decrease in the area sown to peanuts in Burma during the current crop year (1930-1931). Official estimate for this year is given as 551,340 acres as compared with 567,620 acres given as the third estimate of last year. The final estimate last year was 556,296 acres. This season's crop is reported to be in better condition than that of last year which in turn was above the average of the previous two years. Production of 195,000 tons of nuts in shells is predicted. The final estimate for the previous crop was 190,000 tons.

California Mill Varies Raw Materials

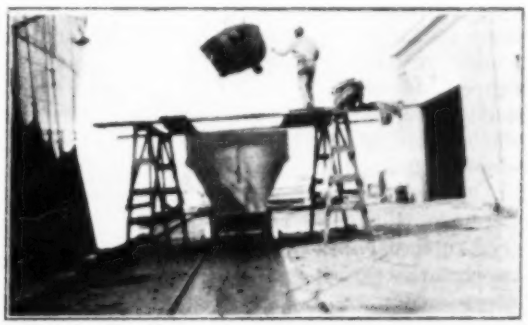
Los Angeles Crushing Plant Equipped to Handle Copra or Sesame Seed as Market Conditions Warrant

By D. A. Phillips

THE Copra Oil and Meal Company, situated on Mormon Island, Los Angeles Harbor, has just completed an addition to its mill for producing oil from copra, the addition being for the purpose of working up sesame seed. Sesame oil produces a choice salad oil when properly refined. Practically the same machinery used for obtaining the coconut oil is used in obtaining the oil from the sesame seed. The plant is now equipped for handling about 500 tons of sesame seed per month.

In this connection it is interesting to note that a serious attempt to raise the sesame plant in this country is now being tried in Imperial Valley, California, but the venture is still in the experimental stage. The free fatty acid in sesame oil is low enough that the natives of China and Manchuria, where most of the seed is produced, use it for edible purposes without refining. The residue of meal left after recovery of the oil is considered equivalent to linseed meal for stock feeding purposes.

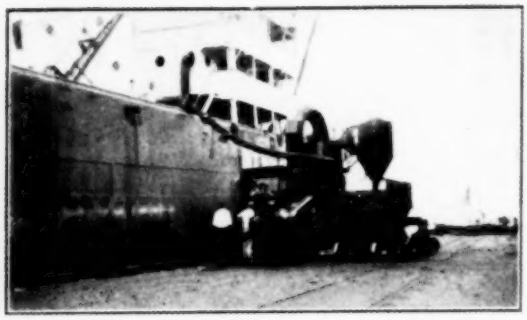
The amount of copra received at Pacific ports has increased considerably in the past few years, and, according to F. W. Woll, of the Agricultural Experiment Station in connection with the California State University, the demands for meal and oil increased greatly in the past dozen or so years. Due to war conditions, European markets were closed for a time to oleaginous raw materials. Within the past few years a great deal of the copra shipped to this country has been coming to Southern California ports, as against previous years, when most of it went to San Francisco, Seattle and Portland, where there were mills for working it up. The largest of the plants at Los Angeles Harbor ran 30,000 tons of copra through its mill last year. As high as 2000 tons has been received in a single cargo. Most of the copra comes from the Philippines and Straits Settlements to the port of Los Angeles.



Unloading copra from a steamer by means of bucket hoist discharging into specially-built truck at Los Angeles

General view of plant of Copra Oil and Meal Company, Los Angeles harbor, showing oil mill, copra elevator and copra storage tanks.

The ordinary method of discharging copra from a ship's hold is by means of grab-bucket elevators operated by the ship's cargo booms. An operator standing on a scaffolding alongside the ship tips the contents of the scoop into hoppers mounted on dump trucks waiting beneath the scaffolding.



Portable suction unloader, operated by gasoline engine, at work discharging copra from steamer in Los Angeles harbor

A somewhat newer method of unloading copra employs the vacuum unloader, a mechanism operating on the principle of the vacuum cleaner, or sweeper. It is run by a gasoline engine stationed alongside the ship. A large hose is thrust into the hold of the ship, through which hose the copra is sucked up by vacuum, being discharged through a drum into the hopper above the dump trucks. In satisfactory operation this suction conveyor unloads material such as copra much more rapidly than do scoop elevators. It is now being tried out, and as yet its possibilities are not fully known, but it is believed that it will greatly facilitate unloading when perfected.*

When the dump trucks are loaded they are hauled to the mill a short distance away, and after passing over platform scales where the copra is weighed, are dumped into the basement. The discharge is through a grating to prevent extraneous matter, such as large pieces of coconut fibre and sacks, from going in with the copra. In some instances, tiny shoes made of coconut shells, and long strands of copra strung on strings by the Filipino children as a pastime, are found in a copra load. On reaching the basement, the copra is carried in bucket elevators to the top of the building, whence it is discharged into the tops of the tall storage tanks, each of which has a capacity of about 875 tons. This mill has about a half-dozen of these tanks, and the others in the Los Angeles area have three each or more.

When the copra is to be run through the mill, it is taken from the bottom of the tanks. On being taken by conveyors from the tanks, it is automatically weighed, as it goes on its way, by scales which weigh 175 pounds to the spill, the scale counter registering any overweight or underweight. The copra proceeds by another conveyor from the scale house to the mill, passing over a magnetic pulley, for the removal of any iron or other metal which may be in the mass. Pieces of iron nearly as large as a man's fist have been found in the copra.

The raw material is next conveyed to the breakers, where it is reduced to small pieces. From the breakers it goes to the driers, thence to the tempering apparatus of the expellers. The next step in the journey is through the expellers. Those in use here are of the Anderson type, and it is claimed that all the oil is expelled at one operation. This type is being used here for the first time.

The oil, at first mixed with fibre and meal, goes to the basement to be settled for the "foots" removal. It is then pumped upstairs to the agitating tank, thence through the filter process, where the oil is forced through canvas cloth at high pressure. A thirty-six plate press is used. As the stream of oil comes from the filter press it goes into a large tank, and is later pumped into the storage tanks to await shipment.

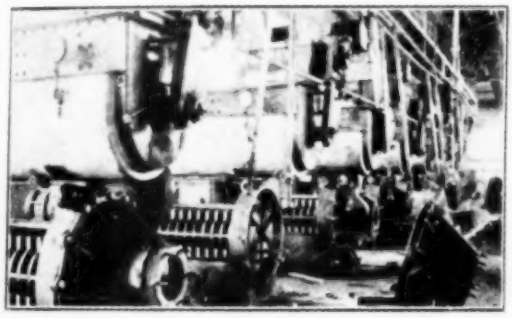
Dump truck discharging copra into house conveyor at plant of Copra Oil and Meal Company

* *Editor's Note*: Suction unloading equipment was successfully applied to copra in Portland, Oregon in 1920, and in Philadelphia in 1923. These installations were stationary, however, unlike the portable outfit described in this article.

Battery of steam-heated driers used for drying copra at plant of Copra Oil and Meal Company

A great deal of the coconut oil produced here is used by soap manufacturers, much of it being utilized in Los Angeles, but a considerable proportion is shipped to the middle western, southern and eastern states.

For the sesame oil plant a building 340 feet long and containing a four-expeller equipment has just been completed. No hydraulic presses are used here, the type being exclusively



Press room of Copra Oil and Meal Company, showing installation of Anderson Expellers for copra crushing

Anderson expellers. The company expects to dispose of some of the sesame oil to soap factories for making high-grade soap, and the remainder will go to refineries where it will be converted into salad oil. Practically all the auxiliary equipment of the mill can be utilized on either copra or sesame seed, or on flaxseed, thus materially reducing overhead and keeping the plant in operation throughout the year.

This provision for handling various raw materials brings this Pacific Coast mill more nearly into the class of the large oil-milling establishments of Europe than is any other oil-milling project of this country, with the exception of one or two linseed mills which also handle copra.

Mayonnaise Fellowship Report

Lowell B. Kilgore, Research Fellow of the Mayonnaise Manufacturers Association, has forwarded his first progress report to the Board of Directors of the association.

The program of work mapped out for the Fellowship includes intensive investigation of the fundamental problems, particularly with respect to the use and the keeping qualities of oils in mayonnaise, the analytical methods applicable to egg yolk and the effect of egg yolk on the stability of mayonnaise. This subject of stability of the mayonnaise emulsion will also be carefully studied from every standpoint, under the Fellowship.

The problems bearing particularly upon oils are outlined herein, as being of particular interest to our readers.

1—Under the heading of "Oils" in which cottonseed and corn oil were used, methods for isolating and identifying unsaturated compounds produced by short wave illumination of the acidified oils are under investigation. As the unsaturated compounds in oils are an important cause of rancidity, this investigation is of practical value in the recognition of oils which are prone to rancidity; and the method will be useful also in determining the efficiency of substances that may be added to oils to prevent the development of such rancidity. Similarly, the unsaturated compounds produced at elevated temperatures and in various acid concentrations are being studied. It is said that acidity accelerates rancidity but we have not yet any exact data on the subject. It has also been shown that the oil in mayonnaise approaches the same acidity as the vinegar, which means that the oil takes up acetic acid from the vinegar.

2—The unsaturated constituents of oils are also being studied by the method of bromination. The unsaturated compounds differ in their ability to absorb bromine and the method may throw a new light on the relative tendency of oils to oxidize or go rancid.

3—The familiar color reactions are also being studied including the Kreis test which has been so much discussed in our association. The latter is being compared carefully with the Von Fellenberg test, both as to sensitivity and ease of duplication. The work will undoubtedly lead to better standardization of technique and possibly to the discarding if the Kreis test altogether.

Vegetable Oil Tariff Hearing at Washington

Commission's Investigation of Costs and Marketing Conditions Affecting Imported and Domestic Oils

At the hearing announced for February 17th by the U. S. Tariff Commission, held in an effort to determine costs of production and marketing of certain imported vegetable oils in comparison with costs of domestic oils said to be competitive, the meeting was attended by representatives of various interests who desired to protect certain imported or domestic oils from competition. A report of the hearing follows below.

WASHINGTON, D. C., February 20: A United States Tariff Commission inquiry, launched at the behest of the Senate for the purpose of probing costs of production and transportation of the American markets of coconut oil and copra from the Philippine Islands, and other producing regions, palm oil, kernel oil, whale oil, rapeseed oil, perilla and sesame oils was held at the office of the commission here, February 17, with representatives of interests concerned in sharp conflict on the question of whether imports of these oils are actually in competition with domestically produced fats and oils to the detriment of the latter. For more than six hours, attorney for producers, chemists, manufacturers and technicians caused to be entered upon the records of the proceedings, volumes of statistical argument and scientific opinion in the interests of their respective causes. At the conclusion of the hearing, announcement was made that a period of 30 days will be allowed in which supplementary briefs may be filed. The entire field of oil and fat uses was covered in the hearing, extending from manufacturing to cookery, with expert opinion heard relative to influence of the absence of tariff on most of these oils, on the tinplate field, the preparation of lubricants, oleomargarine production, paint, varnish, soap, biscuit and candy making.

Although it was not disclosed at whose suggestion the Senatorial resolution predicating the inquiry was introduced, the opposition to present conditions was handled almost entirely by Attorney A. M. Loomis, representing the Texas Cotton Seed Crushers Association and the National Dairy Union, and present, as he explained, also as observer for the Oklahoma Cotton Seed Crushers Association. Charles W. Holman, counsel for the National Cooperative Milk Producers Federation, and Attorney W. R. Ogg of the American Farm Bureau Federation, were also aligned with the opposition to continuance of these oils on the free list.

Scarcely a word of protest was uttered against such of the imports as go into the production of soaps, paints, lubricants, etc., the opposition being grounded almost entirely on the argument that much of the oils entering the country is being employed to compete with the American fats and oils used in edibles. Some mention was made of the fact that whale oil, produced in ever lessening quantities in this country, can be employed successfully in soap making, but cross-examination on this point, disclosed that none of the witnesses advancing this claim was in possession of proof to that effect.

Whether or not there is a degree of interchangeability of imported oils with domestic products which is conducive of serious competition was argued at length and it was on this point that most of the technical evidence was adduced. It was principally with relation to the oleomargarine field that the use of palm oil as an edible was argued, Attorney Holman characterizing the growth of this business as the greatest menace the dairy business has ever faced. He presented a report of the

Bureau of Internal Revenue to substantiate his statement that palm oil, sesame and coconut oils, imported to this country, are steadily eliminating oleo oil, cottonseed oil and peanut oil, domestic productions, as ingredients in the manufacture of oleomargarine, and he predicted that unless the situation is cured, American dairymen will be forced into the international market to dispose of their butter fat.

William R. Morse of New York City, told the commission that the fishing corporation, of which he is the head, has not operated for two seasons, due to the inability of meeting foreign competition in oils. His corporation produced fertilizers and fish oils. Mr. Morse presented the objections of the American Fish Oils Association, the Virginia Fish Association, the California Fish Consumers Association and the Pacific Packers Association, members of which, he said, are experiencing depressions similar to his own. His statement that fish oil is used to make soaps was challenged by Daniel McIver of the Original Bradford Soap Works, who demanded to know what type of soap is so manufactured, and who declared he has heard of no fish oil soap other than that which is used as an insecticide. Mr. Morse was not in a position to amplify his statement, explaining that it is his understanding that this product is so used, but that he could not vouch for the fact. Reports on experiments made by the United States Bureau of Fisheries in the use of fish oil as an edible produced much discussion and while a technician of that department, J. R. Manning, admitted the possibility that the taste might not be all that would be desired, he insisted vitamins important to bone growth are assimilated through the use of fish oils. He declared frankly that, with the exception of cod oils, little call is had for the product from this field for human consumption.

Opponents of Increases

HANDLING the argument in favor of the present tariff provisions was John B. Gordon, technical adviser and tariff expert for the Bureau of Raw Materials for American Vegetable Oils and Fat Industries, who introduced witnesses whose testimony was an emphatic denial that there is competition with domestic productions, and who declared that much of the work now being done with imported products cannot otherwise be executed. P. R. Crawford, president of the McKeesport Tin Plate Co., of McKeesport, Pa., spoke with a background of 40 years experience in tinplate manufacture, a field which employs 35,000 workers, told of experiments with substitutes for palm oil in tinplate production and declared that all had been failures. Since no palm oil is produced in the United States, foreign fields must be looked to, he explained. Tallow, cottonseed oil and other domestic products were among those tried, he testified. Of the 128,000 tons brought here annually, about 10 per cent. of the palm oil import is utilized in the tinplate industry, he estimated. As to the use of hydrogenated cottonseed oil for this work, he admitted lack of knowledge.

F. M. Barnes of Cincinnati, O., representing the American Laundry Soap Manufacturers, declared foreign products must be used in making soap because the domestic market does not produce sufficient quantities to meet demands. Palm oil is used extensively by those he represents, but rapeseed and perilla are not employed at all and coconut oil is too expensive, he asserted. After offering testimony corroborative of what had been said by Mr. Barnes, W. B. Chittenden of the American Laundry Soap Manufacturers, and the Colgate-Palmolive-Peet Co., stated that a duty on palm oil would seriously injure the soap industry and cut down on the use of rosin, domestically produced, and use as another soap ingredient. The cottonseed oil production of the United States is not great enough to provide for the needs of the edible field, disregarding the soap industry, he charged.

Representing the Vacuum Oil Co., said to be the largest user of rapeseed oil, A. T. Foster stressed the need of this import for lubricants. Of the 2,500,000 gallons imported in 1929, 1,500,000 to 1,800,000 went into the making of lubricating oils, he told the commission. The requirement for copra, coconut, palm and palm-kernel oils in making laundry soap, and of perilla for paints was discussed by Henry A. Gardner of the Institute of Paint and Varnish Research, and by D. W. Corbin of the Laundrymen's National Association. Mr. McIver, representing makers of textile soaps, declared no substitute can be found for palm oil in fulling textiles.

Because of a misunderstanding, none of the interested parties came to the hearing prepared to submit data on costs of production and transportation, which was the subject of main interest to the commission, but all agreed to include this discussion in briefs to be filed. In the meantime, the commission will take under advisement a request for a hearing at a later date to allow rebuttal of such declarations as may be included in these briefs.

Copra, palm, rapeseed and perilla oils are now admitted to the country duty free; a duty of two cents a pound is levied on coconut oil, one cent on palm kernel oil, three cents on sesame, and $17 a ton on whale oil.

Oil Chemists' Annual Meeting

Convention Again Planned for New Orleans Directly Preceding Meeting of Cottonseed Products Association

The Roosevelt, New Orleans, La.

PRELIMINARY plans are in the course of formulation for the Twenty-second Annual Meeting of The American Oil Chemists' Society. The annual convention of the National Cottonseed Products Association will be held at the Roosevelt Hotel, New Orleans, La., on May 18, 19 and 20th.

The present tentative plans contemplate holding the Oil Chemists' Society meeting on May 14 and 15th, the Thursday and Friday preceding the Cottonseed Products Association meeting.

President W. H. Irwin, of the Oil Chemists' Society, is already well advanced with plans for a most interesting array of scientific papers for presentation at the meeting. Headquarters will undoubtedly be at the Hotel Roosevelt, where so many previous meetings have been held.

Entertainment features will include the Annual Banquet and the Golf Tournament. N. C. (Nick) Hamner, the energetic chairman of the Golf Committee, has marshaled his cohorts and guarantees big doings and important prizes. Nick writes that some of the prizes are already in hand, but that the doors are still open to those generous friends of the oil chemists who desire to contribute further prizes for the tournament. Chairman Hamner urges all members to bring their golf bags and clubs, and their handicaps, (*actual*, not hopeful).

The work of the American Oil Chemists' Society during the past year has shown splendid progress under the able leadership of President Irwin, and every member is urged to attend the Annual Meeting in order to derive personal benefit from the committee reports and scientific papers which will be presented, as well as to spend a few enjoyable days in the renewal of friendships in beautiful New Orleans at its best season.

The Brigham Bill, proposing a tax of 10c per pound on all yellow margarine, where colored artificially or naturally, was passed by the House of Representatives on February 26. The Senate is expected to attempt to amend the bill so as to exempt from the tax such margarine as may be colored yellow by the use of domestic oils as natural ingredients. Such action by the Senate may result in the death of the measure in Conference.

Mrs. Anna Schlorer Smith, Director and formerly Secretary of the Mayonnaise Manufacturers Association, has recently returned to Philadelphia from an extended West Indian Vacation cruise.

A New Method for the Examination of Textile Oils

An Original Procedure for Measuring Oxidizability to Predetermine Desirability of Oils for Textile Purposes

By RALF B. TRUSLER[1]

PART II

Method of Applying the Test

TO examine an oil for its behavior toward oxidation by means of this apparatus, the first step is to place the specimen of oil in the reaction bulb. The bulb should be clean and dry and the cocks greased with a heavy stopcock grease. The tare of the empty bulb is determined, and to it is added 25 grams. This total gross weight will be constant for all experiments. The bulb is then partly exhausted by applying a vacuum, and then by dipping the inlet tube (the capillary tube extending to the bottom of the bulb) into the oil to be examined and opening the cock, the correct weight of oil can be drawn in. A convenient way to determine the weight of the bulb and contents is to suspend it from the hook of a sturdy balance by means of a wire hanger. If too much oil has been drawn in, the bulb can be filled with air under slight pressure, and then by opening the cock the excess oil will drop out while the bulb is still suspended from the balance. The bulb is next connected to a vacuum pump, at the short capillary tube, and exhausted to 2 mm. or less. Air amounting to 2 mm. pressure does not cause an objectionable error for most work. The bulb can be pumped out while the 100 ml. of oxygen are being measured.

The burette of the gas measuring apparatus is lowered to the position shown in Figure 10, filled with mercury, and then elevated (Fig. 8) so that the 100 ml. mark is on the same level as the calibrated mark "M" on the manometer. This level can be indicated with a pencil mark on the wood support as it will be constant for the same calibration of the manometer. The leveling flask is dropped to about the same level as mark M. Oxygen supplied through rubber tubing under slight pressure is then admitted through the stop cock until the mercury level is somewhat below the 100 cc. mark on the burette. Then by adjusting the leveling bulb and letting out a little oxygen the mercury level can be exactly adjusted at 100 ml. With the stop cock firmly closed, the burette is again lowered so that the zero mark is level with M (or line L). A short piece of pressure tubing, G, (Figure 9) must be tightly fitted on the burette. The reaction bulb, which has now been thoroughly exhausted and the stop-cocks securely closed, is connected to the burette through the short piece of pressure tubing. This connection with the bulb is made with the short capillary that goes directly to the top of the bulb. By opening the stop-cock on the bulb and that on the burette, the oxygen is quickly admitted. It is a good plan to twist a piece of wire around the rubber connection at both ends as precaution against leakage. After the oxygen has been transferred to the bulb, the stop-cocks are closed and made tight by rubber bands, and then the bulb is fastened in the clamps of the shaker. In mounting the bulb in the shaker, the inlet and outlet tubes carrying stop-cocks are upright and always out of contact with the oil.

Oxidation in the bulb at room temperature goes on so slowly that no appreciable error is introduced during the periods of loading or unloading. The time the specimen is subjected to oxidation is counted from the instant the motor is started until it is stopped. Of course, unnecessary delay in starting the motor and in removing the bulb after the reaction must be avoided.

After the bulb has been shaken for an optimum time of one hour and at the desired temperature, it is removed from the oil bath, wiped dry, and again attached to the burette which has been somewhat elevated (*Figure 7*). The connection with the burette is made with the same capillary through which the oxygen was

[1]Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa.

introduced into the bulb. As a matter of precaution against oil being drawn into the burette, a small cotton plug should be placed in the rubber connection, and renewed after each determination. The problem now is to transfer the unused oxygen from the bulb back into the burette so that it can be measured. This is done by filling the bulb with oil[7] as the residual oxygen is drawn into the burette. Oil for filling the bulb is supplied from a 250 cc. leveling bottle, through rubber tubing. Care must be taken to exclude bubbles. The cock on the oil inlet side is opened to allow oil to replace most of the absorbed oxygen, and then the balance of the gas is drawn into the burette by opening the cocks and lowering the leveling flask. When all of the oxygen has been drawn into the burette and the bulb is full of oil, the cock on the burette is closed and the bulb is removed.

The amount of oxygen taken up by oil can be measured by leveling the mercury in the burette with mark "M" on the manometer. Although the volume of oxygen now in the burette may be considerably less than the original, it can be accurately measured in terms of the original volume, for again in both systems $P_1 = P_2$ and temperature is the same for both volumes of gas.

The bulb is made ready for a new determination by washing it out three times with a little benzene and drying by suction.

A little discussion should be devoted to the selection of the rate of shaking (140 per minute) and the time of heating the reactants in the oil bath (one hour). The rate of oxidation of an oil in this apparatus depends upon the susceptibility of the oil to oxidation and upon how intimately the oil and oxygen are brought into contact. The former condition we cannot control, but the latter is variable and is the one with which we are concerned mechanically. It was mentioned before that oxygen would be absorbed slowly if the bulb remained still, but oxidation in this type of container under static conditions would involve a long time and much inaccuracy. On the other hand, reaction is facilitated by shaking, as greater surface contact is obtained.

Experimentation showed that an optimum rate of shaking could be selected, such that a small increase or decrease would not seriously affect the results. Too rapid shaking involves the danger of breaking the reaction bulb and also causes too much splashing of oil from the bath. To remedy this, consideration was given to heating and shaking the bulb in a hot air oven, but too much time was required to bring the bulb and contents to the desired temperature, compared to oil bath immersion where the bulb and contents can be heated in about one minute. A short period for reaching the proper temperatures is an essential feature in reducing unconformity between different tests, and this is best accomplished by immersion in a heated liquid.

One hundred forty shakes per minute is an arbitrary value, based upon the conditions just described. Other speeds might have served as well, but the nature of the experiment requires that all of the mechanical ratios and the speed of shaking must be constant during a series of tests if comparable results are required, and that the specifications must be adhered to if similar results are expected from two or more individual outfits.

Temperature and Time Considerations

IN applying the technique just described to the examination of oils, it was necessary to assume some fixed time for the period of shaking in the oil bath. Series of oxidation tests were run upon a technical oleic acid that was known to be moderately oxidizable. The first set of determinations was made for a period of 30 minutes each through the temperature range of 35° to 95° at intervals of from 2.5° to 5°. By plotting the volume of oxygen absorbed

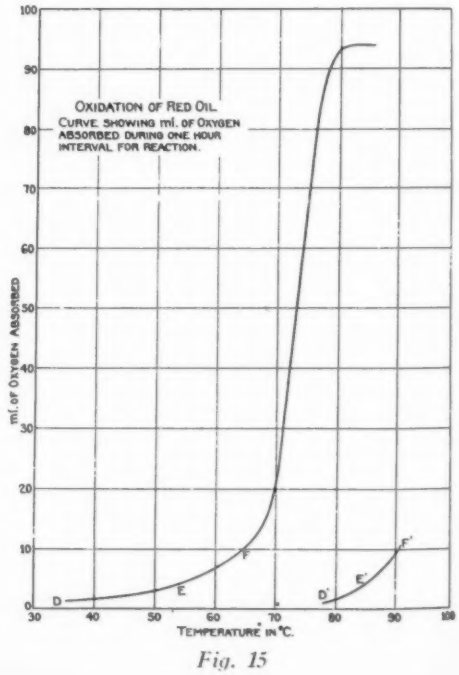


Fig. 15

[7]The same oil as used in the experiment, oil residues from oxidation tests, or any free running oil can be used for this purpose.

(as ordinates) against the temperature, curve A (*Figure* 15) was obtained. A set of determinations was similarly made for periods of one hour (Curve B) and for two hours (Curve C).

The resemblance of the curves is striking, as they follow the same general slope and are parallel for the greatest part of their length. It was found that determinations upon slightly oxidizable oils do not have a satisfactory degree of reaction in 30 minutes to permit representation by curves, while readily oxidizable oils deplete the supply of oxygen through a too long period of shaking. Since 30 minutes and 2 hours both appeared to be extremes, one hour was selected as the best time for reacting oxygen and an oil in the shaker.

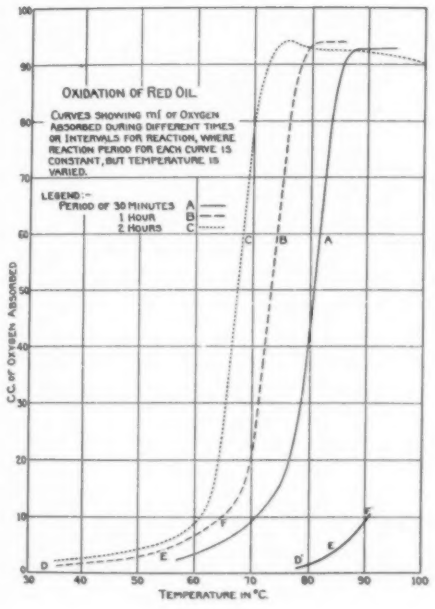

OXIDATION OF RED OIL
CURVES SHOWING CC OF OXYGEN ABSORBED DURING DIFFERENT TIMES OR INTERVALS FOR REACTION, WHERE REACTION PERIOD FOR EACH CURVE IS CONSTANT, BUT TEMPERATURE IS VARIED.
LEGEND:-
PERIOD OF 30 MINUTES A
1 HOUR B
2 HOURS C
CC. OF OXYGEN ABSORBED
TEMPERATURE IN °C.

Fig. 16

Important information bearing upon this method for examining oils is revealed by the curves. A difference in the rate of oxidation at ordinary temperatures can be measured with ease and accuracy without first heating the oil to 100° (as in the Mackey tester) or higher with the consequent destruction of any naturally occurring, low temperature anti-oxidants. It also demonstrates that oxidation is accelerated by increased temperature. The reliability of this method over a wide temperature range for indicating the susceptibility of an oil to oxidation is shown by the nearly straight curves from the point where oxidation becomes rapid

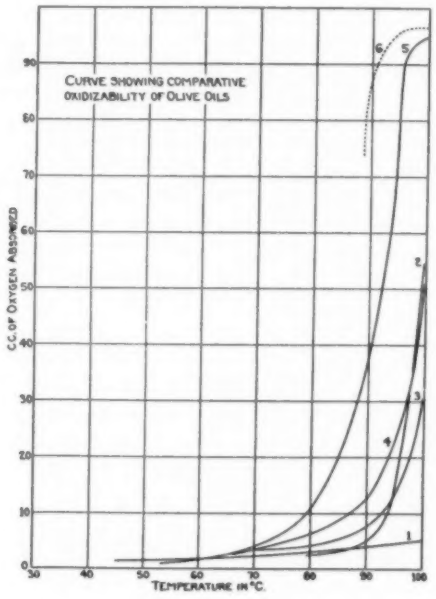


Fig. 17

up to where less than 20 per cent of the original volume of oxygen remains in the bulb, and even more strikingly by only moderate deviation in the rate of absorption until scarcely more than 2 cc. of gas is left and the pressure of the gas in the bulb has dropped to about 4 centimeters.

Fatty oils appear to pass through three stages of oxidation. At low or ordinary temperatures, oxidation produces temporary peroxide combinations[8], which are associated with the subsequent occurrence of rancidity. Increased temperature during oxidation causes stable oxygenated compounds to be formed. At high-

[8]G. E. Holm, G. R. Greenbank and E. F. Deysher, Industrial and Engineering Chemistry, *19*, 156-8 (1927).
W. L. Davies, Chemistry and Industry, *47*, 185 T (1928).

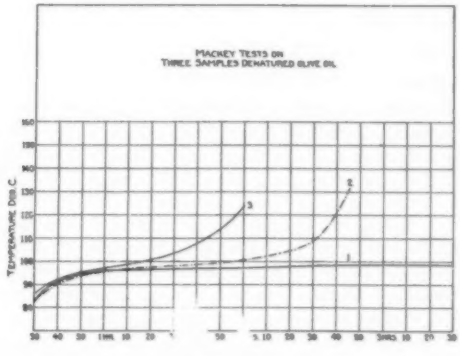


Fig. 18

er temperatures, oxidation resembles combustion in that carbon dioxide is evolved. This last reaction is most common with unsaturated fatty acids. The downward dip in Curve C, *Fig.* 15, was found to be due to the generation of carbon dioxide which gave an increase in the volume of gas in the tube. Determinations of the temperature or temperature-time factors which are responsible for the production of CO_2 have not yet been made.

Accuracy of the Method

DUPLICATE tests upon oils and check runs at various temperatures were frequently made in order to note the accuracy and consistency of this method for examining oils for their tendency toward oxidation. It was found that with ordinary care taken in exhausting the bulb, protection against leaks and in leveling the burette, results can be easily duplicated to within 0.2 cc. (approximately 0.2%) deviation. In some cases moisture affects the results and it is therefore advisable to employ dry oils.

The question naturally arises whether or not one is justified in substituting oxygen for air in determinations upon the stability of oils, especially, since most instances of oxidation occur in air. In so far as the measurement of the degree of oxidation to which an oil is susceptible, is concerned, oxygen provides a more accurate means because the total volume shrinkage can approach 100%, while with air only approximately 20% is possible. Of course the method might be modified so that a larger volume of air could be used in respect to the weight of the oil sample, but the size of the apparatus soon becomes cumbersome. Oxygen provides a more energetic treatment without thermal decomposition, and if an oil can be shown to resist oxidation at temperatures above normal under such treatment, its safety and resistance to any form of oxidation in air is reasonably assumed.

Accepting the arbitrary period for shaking of one hour as a standard, B (*Fig.* 16) is a representative curve and is subject to certain interpretations. The portion D-E-F designates the conditions for moderate oxidation. Below 54° (at E) oxidation takes place at a comparatively slow rate. From E. to F, or from 54° to 65°, the oil is more reactive, while above 65° oxidation becomes rapid. If this oil were used in some technical process wherein it would be spread out in thin films and well insulated, as in the case of certain textile operations where considerable amounts of wool, for example, may be oiled for lubrication during the stages of processing, oxidation would be enhanced owing to the large surface contact with atmospheric oxygen. The susceptibility of the oil upon the fiber to oxidize would then be dependent upon the temperature. The fiber always entrains sufficient air to provide oxidation, and therefore penetration of air into the pile is not necessary for the reaction. In fact, good circulation of air through a pile of oiled fiber is one means for carrying away accumulated heat and provides a factor of safety against what is usually designated as spontaneous combustion. It may be said, then, that below 55° oxidation would not be particularly dangerous, providing that the heat of reaction can be led away.

Suppose that another textile oil was found to be more resistant to oxidation and could be represented by the hypothetical curve D'E'F'. In this case, only appreciable oxidation would occur at 85° (E). Owing to an increased dispersion of heat at higher temperatures, there is little probability of oiled fiber reaching this temperature with the meager amount of heat accumulated from such a slow rate of oxidation, and the possibility of reaching F becomes remote. Therefore, while the oil represented by the Curve B is a possible hazard[9], an oil whose susceptibility to oxidation might be shown by a curve similar to D'-E'-F' could scarcely be the source of any danger from any spontaneous and rapid combination with oxygen.

Comparison of Results of the Mackey Method and of the New Method of Examining Oils

INASMUCH as many commercial laboratories are accustomed to qualifying textile oils by the Mackey method and specifications, it became advisable to make a few determinations upon textile oils by this means in order to determine if the results of one method might be interpreted in terms of the other. At the present time it can be said only that the two methods are comparable to a reasonable degree, but that the Mackey test may produce some unexpected differences when the data are compared with those of the oil-oxygen method.

A comparison of the results of the two methods of examination is depicted by *Figures* 17 and 18.[10] In Figure 17 are shown curves representing the susceptibilities of oxidation of six different specimens of denatured olive oil. The oil represented by curve number one was the least affected by the treatment, while oils num-

[9]Depending upon factory conditions, as previously explained.
[10]From data contributed by Stanley Goranflo, Wilson-Martin Co., Philadelphia, Pennsylvania.

(*Turn to page* 109)

Vitamins and Palm Oil in Margarine

Vital Elements of Nutrition Always Found in Association with Yellow Coloring Matter, Carotin, in Plant Life

By ALBERT K. EPSTEIN

THE oil soluble vitamins A and D are recognized to be important constituents of the human diet. Dr. J. C. Drummond in his chapter on "The Nutritive Value of Edible Oils and Fats" in the book published in 1928 by E. Richard Bolton, entitled "Oils, Fats and Fatty Foods," pages 402 and 403, says the following regarding palm oil:

"Palm oil provides another interesting example of the association between vitamin A and the fat-soluble pigments that has been noticed, and specimens have been examined and found to possess a growth-promoting activity not much below that of butter."

In applying the recently developed Drummond color test for Vitamin A to various samples of refined palm oil, I have found that the unbleached colored oils gave a test corresponding to a high vitamin content, and the intensity of the reaction diminishes with the amount of bleaching and oxidation the oils have undergone.

I personally made tests on samples of palm oil which were made from carefully selected raw material and which were refined and deodorized by careful methods, and I found them to respond to the Drummond color test for vitamin A equivalent to about 60 units per gram, which is a higher test than that given by the average butter and equivalent to the test given by the best and richest butter in vitamin A.

It has already been observed by Prof. Steenbock of Wisconsin University and other experimenters that vitamin A is associated with the yellow coloring matter carotin which is present in many vegetable products and also present in palm oil, and that oxidation and heat which destroy the color in palm oil will also destroy the valuable vitamin A. As far back as 1922, Drs. J. C. Drummond and S. S. Zilva of the Biochemical Laboratory Institute of Physiology, University College, London, and the Biochemical Department, Lister Institute, London, have made feeding tests for the growth-promoting vitamins in palm oil and have found that,

"The more highly pigmented samples appear to show the higher growth promoting activity in the feeding tests. More than one sample has possessed as high a potency as that exhibited by the average sample of butter." (*Journal of the Society of Chemical Industry, Volume* 41, *page* 127, *T* 1922.)

Recent researches confirm the fact that the vitamin A is a substance which is either identical with carotin, which is responsible for the yellow color in plants and palm oil, or it is always associated with the carotin and if the yellow coloring is removed, the vitamins are removed with it.

It is therefore seen that the yellow coloring matter of palm oil is associated with the content of the growth promoting vitamin A and that palm oil is a vegetable edible oil which is rich in this valuable vitamin. This oil readily lends itself to be used in the manufacture of margarine in view of the fact that it is solid and contains a large amount of palmitic acid which gives the margarine certain valuable physical properties in that it makes it *more plastic* and *less brittle* than if an equal amount of coconut oil is used. This physical property together with its richness in the important food constituent vitamin A, which is absent in all other oils, makes this oil a desirable constituent of margarine.

Drs. Drummond and Zilva in the above mentioned publication in 1922, state:

"The main object of these experiments was to seek a cheap source of vitamin A in the form of a vegetable oil suitable for margarine manufacture. * * * *"

The science and technology of refining edible oils has been greatly enhanced during the past ten years since 1920-22, when Drummond and Zilva experimented with palm oil. By applying the accumulated experience in selecting good raw materials the American Refiner can produce at present an edible palm oil which is palatable and which contains an abundance of vitamin A, equal in potency to some butters and in some cases more potent than the average butter.

It is also known that vitamin D usually accompanies vitamin A. At the time Drummond made his feeding experiments in 1922 there was no differentiation made between these two vitamins. Spectrophotometric examination made on a good sample of palm oil indicates that it may also contain vitamin D to the extent of about five units per gram.

Textile Oils

(*From page* 106)

bers 5 and 6 were rather easily oxidized. When oils numbers 1, 2 and 3 were tested by the Mackey method, they gave the results shown in *Figure* 18. By comparing the curves obtained by the two different methods it can be seen that the Mackey test bears an agreeable relation to the new method in the appearance of the curves, which of course indicate oxidation at considerably higher temperatures.

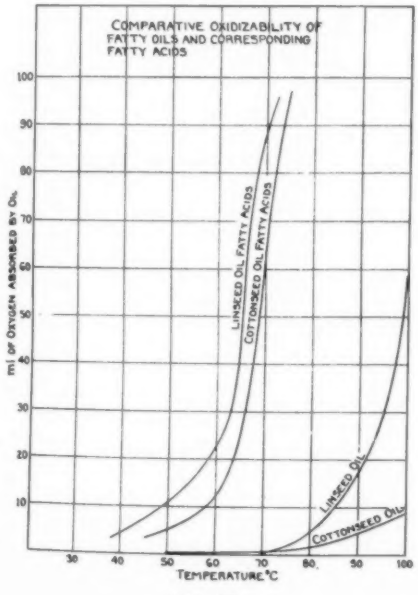


Fig. 19

Application of the New Method to the Study of Oils

THE new method for examining oils permits numerous applications to problems dealing with the behavior of oils toward oxidation. For example, the presence of unsaturated, free fatty acids in a glyceride were found to render an oil more sensitive to oxidation.[11] This effect is clearly presented in the curves of *Figure* 18.

The accuracy of this test permitted an extensive study of textile oils, in regard to their stability in the presence of oxygen, and also gave a means for evaluating numerous antioxidants and for measuring their effect upon oxidizable oils. The evaluation of antioxidants, untreated and stabilized oils is presented in another publication.[12]

[11] H. Aspergren, *loc.cit.*
[12] See Textile World, March 8, 1930.

Cohune Nut Cracking

A new type of dekerneling machine for cracking babassu, cohune, coquita and similar tropical oil-bearing nuts has been perfected by a machine designer of Plainfield, New Jersey, according to reports. The machine is said to be capable of handling nuts of any size and of cracking them open regardless of the shell thickness. The equipment is more than six feet overall height and weighs about two tons. The nuts are dumped into a large hopper, thence being fed to ten dekerneling units through separate tubes. The mechanism of operation is said to be quite simple. As the operation is started, the nuts pass from the hopper through the feed tubes into correct position within the machine. Heavy plungers then descend, rapidly driving sets of tungsten steel cracking chisels into the shells. As the cracking chisels rise, the broken shells automatically spread out. Shells, husks and kernels are thrown onto a sieve which vibrates in a horizontal plane, instantly separating the kernels from the husks and the shells. It is claimed that the machine recovers the kernels entirely undamaged, seldom even scratched.

The Department of Commerce requests all manufacturers of mayonnaise to return the questionnaires covering the department's survey of the mayonnaise industry for 1930, at the earliest possible date. The results of the department's previous survey of the industry were of tangible value to all mayonnaise manufacturers.

Notes of the Industry

British Prices Decline

One of the largest British vegetable oil operators has published a chart depicting the course of the market during 1930 in Great Britain for oilseeds, oils, fats and oil cakes. On a basis of prewar averages, in each case considered as 100, there was a definite downward trend exhibited by all of the commodities named month by month throughout the year. The high price level of the year for oilseeds, and oils and fats, was 114% of prewar levels in January 1930 which offers a marked contrast with the average of 75% for oilseeds in December and 81% for oils and fats. Palm kernels and palm kernel oil had the lowest price index in December when they stood at 55% and 61% respectively of prewar levels. Copra at 58% for December and coconut oil at 62% the same month were second lowest. Among the principal oilcake items, Egyptian cottonseed cake had the lowest index at 78% in December and Bombay cottonseed cake was 83%. Price average on cake ranged downward from 117% in January to 87% in December. (The charts from which this summary was based were secured by American Trade Commissioner Messenger, London, England.)

By estimating the catch of a few ships not reporting, the total production of whale oil by Norwegian companies up to the end of 1930 amounted to about 1,135,000 barrels. At the same time last year the total stood at 828,000 barrels. The production for companies other than Norwegian equalled about 670,000 barrels as compared to 410,000 at the end of 1929. Of these foreign companies, those with strong Norwegian interests represent 270,000 barrels. The total for antarctic catch up to December 31st makes an impressive figure of 1,805,000 barrels as compared to 1,238,000 for 1929.

Cottonseed oil trading on the New York Produce Exchange has been broadened in scope by the inclusion of prime summer yellow oil in the prevailing futures contracts by an amendment to the trading rules. Trading on the exchange has formerly been restricted to bleachable prime summer yellow, and now for the first time the prime oil can be offered on tank-car contracts.

Color Specification Group

During the joint meeting of The Optical Society of America and The American Physical Society, recently held in New York, first steps were taken toward the formation of an Inter-Society Committee on Color Specifications. The first conference of those interested was held at the Museum of Science and Industry on the evening of February 26, under the chairmanship of Lloyd A. Jones, President of The Optical Society of America.

Among many Societies and Associations represented at the conference were: The American Optical Society, American Chemical Society, American Institute of Architects, American Oil Chemists' Society, American Physical Society, American Psychological Association, American Railway Association, (Signal Section), American Society for Testing Materials, American Standards Association, Illuminating Engineering Society, Society of Motion Picture Engineers, Technical Association of Pulp and Paper Industry, and The Textile Color Card Association of the U. S.

Several corporation were also represented, and a number of individuals interested in color specification were present.

Those attending the conference voted unanimously to report to the various organizations represented that the conference recommended the formation of an Inter-Society Council on Color Specification, to be composed of Delegates authorized by the several interested Societies.

The Lookout Oil and Refining Co., of Chattanooga, Tenn., producers of cooking and salad oils, are improving their plant by the addition of new machinery at a cost of $90,000.

C. W. Hazen, superintendent of the Valley Cotton Oil Company, of Memphis, has been elected president of the Civic Club of Whitehaven, Tennessee, suburban to Memphis.

A petition to raise the lard import duties in Czechoslovakia has been presented to the ministry of finance by the Association of Wholesale Dealers. The petition, according to the Department of Commerce, asks that the present duty of $4.45 per 100 kilos be increased to $10.67.

Alvah E. Peterson has been appointed General Supervisor of Sales for the Procter and Gamble Company in the Boston District. Mr. Peterson was formerly located at the general offices in Cincinnati as assistant in the Eastern Sales Division.

The Federal Trade Commission sent to the Senate, on February 16, an interim report of progress on the cottonseed investigation which the Commission has been conducting at various points in the south for some time past. This was the fifth interim report which has been submitted since the beginning of the investigation. The record of testimony transmitted with this fifth interim report alone is in 20 volumes containing 2290 pages and copies of 225 exhibits submitted in evidence. The sixth interim report is now in course of preparation, covering the testimony taken at hearings held at Columbia, South Carolina, between November 10 and December 5, 1930. Additional hearings were held at Dallas, Texas, beginning February 16, and at Jackson, Mississippi, starting March 2.

The annual banquet of the Oil Trades Association of New York was held at the Hotel Roosevelt on February 18. A reception at 7.00 P.M. was followed by the dinner at 7.30.

Swift and Company plan to add a general line of canned fruits and vegetables to their other sales items. The new products will be marketed under the Swift brands.

President McKeldin of the Mayonnaise Manufacturers Association has appointed a Committee to investigate and study the possibilities of service to the mayonnaise industry of a uniform and simplified cost accounting system.

Sales of cottonseed products were made at Memphis during the last week of February on the basis of the following prices: crude oil, tank car, 6½c per pound; 41 percent meal, $25 per ton; 43 percent meal, $26 per ton; hulls $8.50 per ton.

On February 18, The Procter and Gamble Company initiated operation of their copra mill at Baltimore, recently acquired by purchase from the Oil Seeds Crushing Company.

New Books

ELEMENTS OF CHEMICAL ENGINEERING: By W. L. Badger and W. L. McCabe, 8vo, 625 plus xvii pages. New York, McGraw-Hill Book Company. $5.00

MESSRS. Badger and McCabe, well-known chemical engineers and respectively Professor and Assistant Professor of the subject at the University of Michigan, have here contributed an outstanding textbook to the rather meager literature of chemical engineering. The authors have approached their subject with that spirit of respect for order and related development which is such a necessary qualification of the chemical engineer. In recognizing that the modern practice of chemical engineering rests upon a thorough understanding of the basic Unit Operations, this work is devoted chiefly to a thorough analysis of these operations, as comprised in flow of fluids, flow of heat, evaporation, air conditioning, drying, distillation, gas absorption, extraction, crystallization, filtration, mixing, crushing and grinding, and size separation. An interesting addition is a chapter on the engineering considerations covering the design and application of weighing machinery and conveying machinery.

This textbook offers such an attractive blend of underlying theory and practical methods of application that it should serve the graduate practicing engineer as well as it undoubtedly will the student.

A. P. L.

INDUSTRIAL RESEARCH LABORATORIES OF THE UNITED STATES: (Including Consulting Research Laboratories) Bulletin Number 81 of the National Research Council. Fourth Edition, Washington, D. C., 1931, 266 pages. $2.00.

THIS latest revision of the Directory of Research Laboratories appears complete and up to date. There are to be found within its covers an alphabetical list of about 1625 laboratories, a list of more than 1900 directors of research, a geographical index and a subject index. As a reference list it should be of value to all who are interested in research in pure or applied science.

Fat and Oil Data for Fourth Quarter 1930

Production, Consumption, Exports and Imports with Factory and Warehouse Stocks December 31, 1930

WASHINGTON, D. C., February 4, 1931.—The Department of Commerce announces that the factory production of fats and oils (exclusive of refined oil and derivatives) during the three-month period ended December 31, 1930, was as follows: vegetable oils, 1,003,813,580 pounds; fish oils, 27,814,528 pounds; animal fats, 515,598,363 pounds; and greases, 88,509,932 pounds; a total of 1,635,736,403 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 725,462,965 pounds appears for cottonseed oil. Next in order is lard with 388,936,388 pounds; linseed oil with 131,256,804 pounds; tallow with 125,337,778 pounds; coconut oil with 90,921,026 pounds, and corn oil with 26,166,566 pounds.

The production of refined oils during the period was as follows: Cottonseed, 636,407,386 pounds; coconut, 77,611,919 pounds; peanut, 2,001,988 pounds; corn, 25,481,770 pounds; soya-bean, 2,367,591 pounds; and palm-kernel, 4,398,658 pounds. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statements:

PRODUCTION, CONSUMPTION, AND STOCKS OF FATS AND OILS

(In some cases, where products were made by a continuous process, the intermediate products were not reported.)

KIND	Factory operations for the quarter ended Dec. 31, 1930		Factory and Ware'se stocks
	Production (pounds)	Consumption (pounds)	Dec. 31, 1930 (pounds)
VEGETABLE OILS: [1]			
Cottonseed, crude	725,462,965	692,025,173	114,248,422
Cottonseed, refined	636,407,386	331,745,892	428,609,270
Peanut, virgin and crude	4,923,869	2,510,737	7,888,443
Peanut, refined	2,001,988	2,498,178	1,857,630
Coconut, or copra, crude	90,921,026	159,545,086	164,205,940
Coconut, or copra, refined	77,611,919	79,710,666	22,352,232
Corn, crude	26,166,566	32,784,875	7,882,274
Corn, refined	25,481,770	5,632,544	8,881,799
Soya-bean, crude	6,193,747	4,209,346	12,282,259
Soya-bean, refined	2,367,591	2,074,918	2,665,678
Olive, edible	679,075	508,391	8,354,428
Olive, inedible	9,500	1,487,502	1,779,873
Sulphur oil, or olive foots	—	10,089,843	29,249,433
Palm-kernel, crude	332,126	15,350,678	15,234,364
Palm-kernel, refined	4,398,658	3,349,652	2,055,156
Rapeseed	—	2,697,526	5,370,682
Linseed	131,256,804	69,206,656	113,594,170
Chinese wood or tung	—	17,376,409	49,599,494
Chinese vegetable tallow	—	936,087	3,502,168
Castor	10,036,527	4,159,124	8,378,763
Palm	—	54,785,195	92,301,979
All other	7,831,375	7,857,698	7,129,245
FISH OILS: [1]			
Cod and cod-liver	356,729	3,791,861	10,611,506
Menhaden	3,516,095	4,154,070	11,350,516
Whale	5,789,438	16,476,641	57,070,796
Herring, including sardine	17,304,645	15,398,895	100,342,637
Sperm	392,805	325,291	4,327,364
All other, (including marine animal)	454,815	2,556,540	14,067,648

[1] The data of oils produced, consumed, and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries.

PRODUCTION, CONSUMPTION, AND STOCKS OF FATS AND OILS (Continued)

KIND	Factory operations for the quarter ended Dec. 31, 1930 Production (pounds)	Consumption (pounds)	Factory and Ware'se stocks Dec. 31, 1930 (pounds)
ANIMAL FATS:			
Lard, neutral	5,764,907	4,152,024	1,356,653
Lard, other edible	383,171,481	6,960,459	44,086,081
Tallow, edible	12,583,384	10,133,389	4,119,445
Tallow, inedible	112,754,394	132,386,105	140,954,169
Neat's-foot oil	1,324,197	1,132,034	1,424,297
GREASES:			
White	15,240,360	9,878,578	8,811,696
Yellow	19,654,235	9,082,599	11,530,686
Brown	11,447,491	13,735,613	12,888,589
Bone	5,991,197	26,730	2,916,595
Tankage	12,578,302	94,833	5,756,087
Garbage or house	18,521,706	13,599,811	25,538,475
Wool	1,987,224	1,002,965	3,372,941
Recovered	1,019,920	881,297	3,989,932
All other	2,069,497	1,173,901	2,406,234
OTHER PRODUCTS:			
Lard compounds and other lard substitutes	331,412,492	558,788	26,672,374
Hydrogenated oils	164,887,718	145,584,586	23,298,070
Stearin, vegetable	3,677,923	4,588,528	2,103,826
Stearin, animal, edible	13,457,907	10,741,527	3,101,088
Stearin, animal, inedible	3,233,501	3,965,453	7,286,991
Oleo oil	26,121,276	12,069,841	19,686,439
Lard oil	2,350,585	2,396,571	3,655,945
Tallow oil	1,269,223	1,950,188	1,711,206
Fatty acids	33,142,289	31,266,091	10,975,043
Fatty acids, distilled	10,400,323	8,272,253	4,444,827
Red oil	7,422,586	5,337,245	5,788,752
Stearic acid	6,419,746	2,131,410	5,515,328
Glycerin, crude 80% basis	32,980,423	38,298,245	12,793,160
Glycerin, dynamite	13,460,752	7,148,175	9,160,185
Glycerin, chemically pure	19,550,975	2,030,697	6,829,504
Cottonseed foots, 50% basis	91,308,356	73,905,080	74,330,938
Cottonseed foots, distilled	20,525,277	18,708,002	7,318,099
Other vegetable oil foots	18,590,302	14,307,599	4,068,471
Other vegetable oil foots, distilled	296,890	608,497	337,269
Acidulated soap stock	22,497,062	10,914,301	27,032,579
Miscellaneous soap stock	417,130	958,052	1,528,717

RAW MATERIALS USED IN THE MANUFACTURE OF VEGETABLE OILS

KIND	Tons of 2,000 pounds Consumed Oct. 1 to Dec. 31	On hand Dec. 31	KIND	Tons of 2,000 pounds Consumed Oct. 1 to Dec. 31	On hand Dec. 31
Cottonseed	2,407,807	991,341	Flaxseed	206,944	125,218
Peanuts, hulled	5,844	1,733	Castor beans	10,830	7,294
Peanuts, in the hull	2,176	1,017	Mustard seed	151	1,478
Copra	71,134	41,077	Soya-beans	21,251	33,401
Coconuts and skins	543	88	Olives	2,788	90
Corn germs	41,211	258	Other kinds	9,642	4,383

IMPORTS OF OIL SEEDS, QUARTER ENDED DECEMBER 31, 1930.

KIND	Pounds	KIND	Pounds
Cotton seed	15	Poppy seed	1,258
Castor beans	14,818	Perilla and sesame seed	13,055
Copra	105,030	Soya beans	248
Flaxseed	21,114	Other oil seeds	8,378

IMPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED DECEMBER 31, 1930.

KIND	Pounds	KIND	Pounds
Animal oils & fats, edible	663,615	Other olive oil, inedible	1,497,782
Whale oil	388,575	Palm oil	91,151,712
Cod oil	3,561,484	Palm-kernel oil	7,214,738
Cod-liver oil	5,736,191	Sesame oil	25,481
Other fish oils	8,401,763	Vegetable tallow	
Tallow	118,588	Vegetable wax	453,455
Wool grease	1,088,894	Carnauba wax	2,291,907
Grease and oils, n.e.s. (value)	$15,246	Rape (colza) oil	3,987,585
Stearine and fatty acids	1,797,477	Linseed oil	16,752
Olive oil, edible	18,055,601	Soya-bean oil	1,679,675
Peanut oil	1,569,226	Perilla oil	
Other edible vegetable oils	5,862,423	Other expressed oils	479,423
Tung oil	23,639,139	Glycerin crude	3,258,466
Coconut oil	94,552,005	Glycerin, refined	1,307,101
Sulphur oil or olive foots	10,594,019		

EXPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED DECEMBER 31, 1930.

KIND	Pounds	KIND	Pounds
Animal fats & oils, edible	1,500	Coconut oil	510,577
Fish oils	585,010	Palm & palm-kernel oil	234,116
Other animal oils & fats, inedible	11,381	Peanut oil	18,586
Olive oil, edible	19,484	Soya-bean oil	500
Tung oil	1,316,899	Other expressed oils & fats	259,735
		Vegetable wax	161,876

EXPORTS OF DOMESTIC FATS AND OILS, QUARTER ENDED DECEMBER 31, 1930.

KIND	Pounds	KIND	Pounds
Oleo oil	14,199,170	Other animal greases & fats	18,039,702
Oleo stock	1,979,784	Cottonseed oil, crude	1,845,366
Tallow	1,456,514	Cottonseed oil, refined	4,699,871
Lard	129,061,885	Corn oil	175,035
Lard neutral	2,833,216	Vegetable oil lard compounds	1,552,065
Lard compounds, containing animal fats	706,956	Other edible vegetable oils and fats	1,184,922
Oleo & lard stearin	1,582,894	Coconut oil	5,887,867
Neat's-foot oil	375,789	Linseed oil	360,857
Other animal oils, inedible	689,949	Soya-bean oil	1,273,027
Fish oils	640,056	Vegetable soap stock	4,521,745
Grease stearin	1,569,125	Other expressed oils and fats, inedible	1,275,801
Oleic acid, or red oil	278,398	Glycerin	102,468
Stearic acid	62,587		

OIL & FAT INDUSTRIES

The Editor's Page

A Colonial Policy

THE Philippines are in a state of unrest and constant turmoil. The natives have been treated with such fostering care by the United States, that they now believe themselves fully capable of managing their own affairs without our assistance.

They accuse us of exploiting their country for our own selfish purposes, but impartial examination of the facts reveals that our development of the Philippines has taken into account only the welfare of their natives, with never a thought of our own.

We have given of our best in the effort to elevate their standards of living and their ambitions to a level with our own. The schools, colleges and university which we have organized for them are unsurpassed in the Orient. The improvement of roads and other means of communication and of sanitation has gone forward steadily during the twenty-three years of our occupation.

On the economic side, we have offered them *free* use of the greatest market in the world for the disposal of their products, and where any slight barrier has been raised, as in the customs duties on tobacco above a certain annual amount, we have stipulated that the duty shall be paid into their treasury, for the purposes of their government.

The Filipino is a Malay, by temperament and by heritage unfitted for industry of a manufacturing type. He is unsympathetic toward intensive agriculture. He finds his happiest metier in the harvesting of the bountiful crops with which nature has provided him, coconuts, hemp, tobacco and others requiring little cultivation in his tropical clime.

How much better for the Filipinos and for Americans it would be for this country to adopt a definite policy of encouraging the development in the Islands of those crops which cannot be produced in this country, such as copra, cacao, rubber and coffee, closing our markets by means of reasonable tariffs to the importation of products which compete with our own produce, such as sugar, tobacco and many others, and protecting American crushers of vegetable oils, who are well able to handle the copra output of the Philippines, by placing a moderate duty upon oils, while leaving copra and other tropical oil-bearing materials on the free list.

Encouraging Progress

ANOTHER Annual Meeting of the American Oil Chemists' Society is approaching. The American Chemical Society has just concluded a gathering in Indianapolis. At this season there is held a series of meetings of various scientific and engineering societies interested in all phases of scientific research and development.

We have previously, in these columns, directed the attention of crushers and refiners of oils to the value to be derived from encouragement of their chemists to join appropriate scientific societies and to take an active part in the deliberations of those bodies.

We take this occasion, again to urge that those who employ chemists and engineers for the solution of problems in connection with the production and refining of oils, should do all in their power to help their chemists and engineers to obtain the greatest possible benefit from contact with others interested in the same problems, at the meetings of their respective societies.

The expense of maintaining membership for your chemists in the American Chemical Society and the American Oil Chemists' Society, and of sending them to the convention of the latter body, at least, will undoubtedly be repaid many times over by the additions to their store of knowledge of oil and fat chemistry to be gained by such attendance.

The great bulk of advancement in knowledge of oil and fat chemistry may be attributed directly to the efforts of these societies. It is not only encouragement of an important class of employes which should impel manufacturers to support this work, but the best of sound business policy for the promotion of greater profit as well.

The following table shows the exports of cod liver oil from Norway destined for the United States during the year 1929 and 1930:

	1929		1930	
	Gallons	Value	Gallons	Value
Cod liver oil, medicinal	147,700	$141,000	87,840	$71,683
Cod liver oil, industrial	26,452	12,480	109,340	45,397
Cod liver oil, for poultry	18,040	11,260	6,790	4,147

In addition to the above there was also exported 75,460 pounds of cod liver stearine valued at $4,239 in 1929 while in 1930 exports of this commodity were nil.

Trade Commissioner Rohrer at Manila, reports that production of copra during the year 1930 amounted to 1,014,126,000 pounds as compared with 1,058,342,000 pounds produced in 1929. The production of coconut oil in 1930 amounted to 357,935,000 pounds as compared with 412,506,000 pounds in 1929.

Oil Exports from Russia

Trade statistics of the Soviet Government show that in the fiscal year 1929-30 that that country exported 7,027 tons of sunflowerseed oil and 5,667 tons of cottonseed oil. All of the sunflowerseed oil was exported through Black Sea ports while about 50 per cent of the cottonseed oil went out through those ports. Exports of the same oils for the previous year were 25,739 and 5,378 tons respectively.

Germany was the principal buyer of sunflowerseed oil during the 1929-30 period, taking 3,536 tons, however, the previous year the United Kingdom was the largest taking 14,247 tons. In the case of cottonseed oil Germany was the largest buyer both years, taking 5,477 tons in 1929-30 and 2,133 tons in 1928-29.

The complaint of the South Texas Cotton Oil Company seeking to obtain lower freight rates on cottonseed oil and lard substitutes, in carloads, from Houston, Texas, to New York and points in New England, has been dismissed by the Interstate Commerce Commission. The oil company complained that rates of the International-Great Northern Railroad Company were discriminatory and unreasonably high.

Cincinnati Mailing Device Co., Cincinnati, is now marketing a new and improved safety edge screw cap for use on its mailing cases. All standard sizes are offered.

Frederick K. Morrow, of Gold Dust Corp., was recently elected president of Ward Baking Co., and George K. Morrow, chairman of the board of the Gold Dust Corp., was given the same position with the Ward Company. Gold Dust Corporation and Subsidiaries during 1930 earned net profit, after interest, depreciation, Federal taxes and other charges of $6,688,816, equal, after preferred dividends, to $3.51 a share on the common stock, compared with $7,586,963, or $4 a share, on the same amount of stock in 1929.

In a study of the velocity of reaction in the saponification of fats, the influence of the concentration of soda is said to be proportional to the degree of concentration, for with thirty per cent lye saponification is about twice as rapid as with ten per cent lye. The more diluted lyes are said to be preferable, however, because of the increased contact surface between the weaker lye of greater volume and the fats. *Chem. et Ind.* July, 1930.

Position Wanted: Capable executive, qualified by training and experience as General Manager or Sales Manager of edible oil refinery, compound or margarine business. Experience covers general management in such lines, including all edible oil specialties, coconut butters, salad oil, mayonnaise, margarine. Address Box A12, c/o *Oil & Fat Industries,* 136 Liberty Street, New York, N. Y.

Philippine Copra and Coconut Oil

Copra Production Methods Remain Primitive, Although Modern Machinery Has Been Applied in Crushing Plants

By George W. Hipp*

The coconut palm supplies natives of the Tropics with food, drink, shelter and many other necessities.

PERHAPS no tree is so little known generally, yet is so vitally important, as *Cocos Nucifera,* the coconut palm. There is hardly another tree to be found that has such manifold uses. For centuries, the coconut palm has been the greatest single factor in the existence of tropical natives. It furnishes them with food and drink, their huts are made from its wood and leaves, their clothing also from its leaves, and utensils and fuel from the covering of the nut meat. The dried meat, or copra, gives them a commodity for trade, thereby a source of income.

It is the copra, and the oil extracted from the copra that plays such an important part in our own civilization, in that it in turn furnishes us with food, toilet and household soaps, bakery products, confectionery, and feed for our cattle. The fibrous covering of the fruit also has its uses in weaving floor coverings and other household articles. A Singhalese proverb states truly that the coconut palm serves 99 different purposes, and that the hundredth will also be found.

The coconut palm is found in great abundance in Southeastern Asia and Oceania. It is also native throughout the American tropics but in scant abundance, insufficient for most

* *Spencer Kellogg & Sons Sales Corporation.*

commercial purposes. The tree is not indigenous to Africa where the oil palm, from which palm oil and palm kernel oil are obtained, flourishes. Here it is well to differentiate between the coconut palm and the oil palm. They are entirely different species, do not grow in abundance in the same localities, and their oils are not at all similar in characteristics. While they can be used one with the other, they cannot be entirely substituted for each other.

The coconut palm thrives best between the two tropics, in a high temperature, ample sunshine and a heavy, evenly distributed rainfall. The tree does not store much moisture, therefore it flourishes best where the roots can reach the water and where it has the additional advantage of the seawinds. It is essentially a lowland, and particularly, a coastal plant. Sunlight is of extreme importance, as is also good soil drainage.

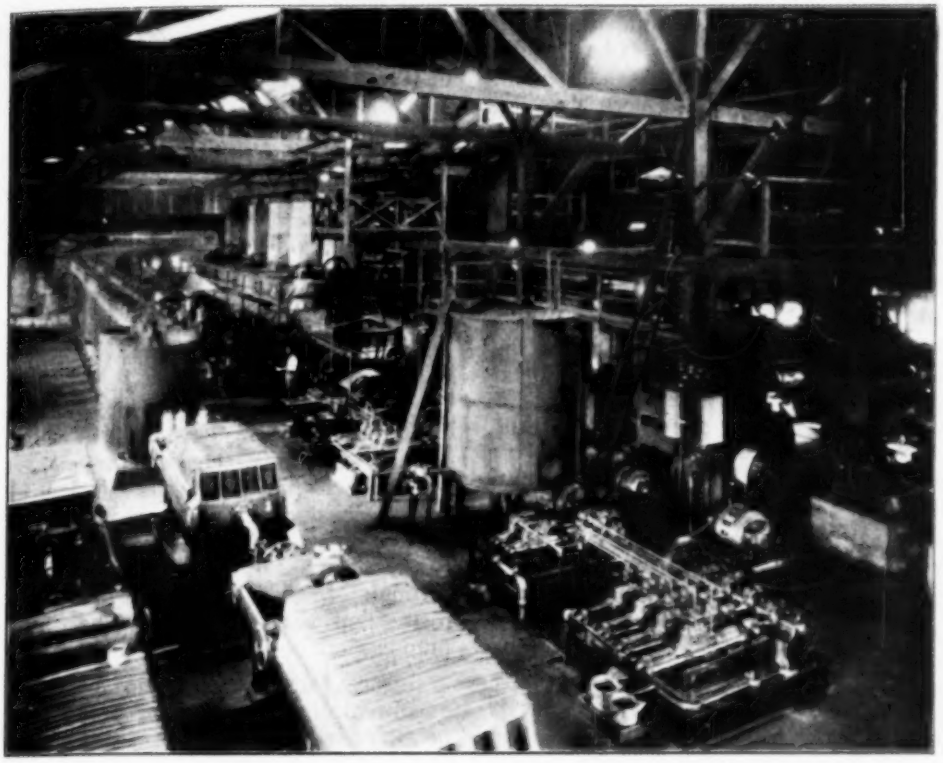
Ordinarily it takes from five to eight years for a coconut palm to bear fruit, and under average conditions, the tree reaches full bearing about the tenth year. While the life of the tree is not definitely known, it is estimated at between seventy and eighty years. Naturally, toward the end of the tree's life, its bearing diminishes. The period of bearing is, perhaps, sixty years. The tree forms but one vegetative bud during its life, and from this the branches develop, from twelve to nineteen a year. The nuts develop in the axils of the branches. In certain sections, climatic conditions governing, bearing trees produce varying quantities annually. Trees in some localities have been known to produce as many as two hundred nuts, but that is a rare exception.

The coconut crop must be harvested at various times during the year as the nuts mature. The nut is of slow development and takes about a year to ripen. The mature fruit has a smooth, yellowish outer covering, underneath which is a fibrous layer or husk up to two inches in thickness. The seed, or kernel, is encased in a hard shell in a cavity of the husk and in this shell is the meat, about one-half inch thick. It is spherical in shape and hollow inside, is perfectly white and has a taste something like almonds. As long as the fruit is not ripe, the hollow contains a sweetish liquid, or coconut milk, which in the course of maturity becomes a fleshy pith. The meat of the coconut palm when dried becomes copra, and this is the source of coconut oil. This product has become one of the most important of the Philippine Islands, which supply the greatest share of our needs.

Primitive Production

COPRA production in the Philippines is still in a rather primitive stage. Plantation cultivation does not exist on a large scale, and the quantities thus obtained are far in the minority when considering the entire production. For the most part, copra is produced by

A Manila warehouse for copra in bags, well-filled with the produce brought in by natives



Interior of a modern copra mill at Manila, showing hydraulic presses, cookers, filter presses, hydraulic pumps and accumulators

natives operating in a meager way. These natives cultivate perhaps a few acres. The bearing trees require little or no attention except in gathering the crops, and therefore the native has time for other pursuits, such as truck farming or working for others in the better organized productions of rice, abaca (hemp), tobacco and corn.

When the fruit is ripe, the nuts are taken from the husks and split in two, usually by axes. There are two generally used methods of drying the copra, sun-dried and smoke-dried. In those sections where plenty of sunshine can be expected, the meats in the half shells are placed on racks and left in the sun to dry. In the course of drying the meat separates from the shell. The meat is sufficiently dried or cured in from three to five days after which it is packed in sacks and is ready for the market.

Smoke-dried copra is produced in those sections where there is insufficient sunshine. The preparation for drying is the same as for sun-dried. The meats in the shells are placed on a bamboo grate under which is built an oven. The discarded husks are used for fuel. The meat is dried by the hot air and smoke from the oven and is cured in about twelve hours.

The cured copra in bags is taken by the natives to a trading station and sold or traded for other merchandise, or both. The trading stations gather an accumulation and sell or trade it to dealers in the large concentration centers, where it is sold to the Philippine mills for crushing into coconut oil, or for export, usually to crushers located on the Pacific Coast of the United States.

Since credit and banking facilities are unknown to the native copra producers, the medium of exchange is cash. This follows all along the line, and when a crusher contracts for a quantity of copra, he has to cover immediately with cash. Copra is purchased on contract for shipment from interior concentration points. It ordinarily takes thirty days after the copra is bought and paid for before it is available either for export or for crushing at Manila or Cebu, where the Philippine crushing plants are located.

Modern Crushing

WE NOW come to the parting of the ways. East meets West and copra comes under

the spell of a highly specialized and scientific development. The East has done its part in giving to the world its product. It has labored under many difficulties with the crudest methods. The call of the West has been answered with a challenge to carry on and to fulfill its part in making available the many benefits which the product has to offer.

The West's acceptance of that challenge, the invention, system and organization it has built to meet it, forms another story equally interesting in that it transforms the old to the new, the crude to the modern, the East to the West. Perhaps the greatest benefit is in the strong bond of mutual understanding and interdependence of two peoples, far different in most of their ordinary modes of living, economically, politically and socially.

The uses for copra, whether exported from or crushed in the Philippines, are the same. Therefore, since we have followed its production there, we shall visit one of the large crushing plants at Manila. When copra is received, it usually contains more moisture than is considered satisfactory for use. It is stored for further drying in large, airy bodegas (warehouses) about thirty days, when it is ready for its conversion into coconut oil.

The copra is fed into a machine which breaks it into very small pieces. It is then ground into a coarse meal and steam-cooked about three hours, then it is passed through the expellers for expression of the oil. The residue, or cake, is broken and ground into a fine meal, again steam-cooked and fed into a hydraulic press which compresses the cake, extracting further quantities of oil. The oil is run through a filter press and then into large storage tanks for shipment to the United States. Copra contains from 60 to 70 per cent of oil. The cake is broken, bagged and sold for cattle feed, principally to European countries.

Transportation again assumes command, and the West demonstrates the magnitude of its operations. For many years, the coconut oil shipped from the Philippines was carried in the ballast tanks of passenger and freight steamers. These tanks are usually placed in the sterm and bow of the vessel and are filled with seawater when no cargoes are obtainable. Naturally, it is of interest to the steamship companies to fill these tanks with oil, as it furnishes them with revenue and ballast at the same time.

Bulk Shipments

ONE large company operating two crushing plants at Manila has placed a fleet of tankboats in service between its Manila mills and United States refineries. These tankers have compartments, each holding about 1000 long tons or 2,240,000 pounds of oil. The capacities of these tankers is around 7000 long tons. The sailing time of passenger ships from Manila to New York or New Orleans is from 65 to 75 days, depending on the number of and locations of other ports of call. The tankboats plying direct take about 55 days. If the steamer has European or Mediterranean ports of call, the Suez Canal route is used. Direct sailings to the eastern seaboard of the United States are made via the Panama Canal route.

For the oil in the storage tanks at Manila, there is another operation before the steamers can be loaded. Most of the crushing plants are located on the Pasig River, which runs through the city of Manila. There are no piers at which the steamers may tie up, as the shallowness of the stream does not permit. Therefore the oil must be loaded into tank barges and lightered to the steamers in mid-stream. The oil is run through a scale, then pumped through pipelines to the tank barges, floated to the steamers and pumped into ship's tanks.

Before a steamer can be loaded, very careful examination and inspection of its tanks must be exercised. They must be absolutely clean and free from odors of other cargoes that may have been in the tanks. They must positively be tight and every rivet tested to be certain of no leakage of seawater into the tank or oil from the tank. They must be steam-coil equipped, as the coconut oil becomes solid at a temperature lower than 72 degrees F. and must be liquefied by heating for unloading in Northern waters.

Coconut oil is very sensitive in its nature and quickly becomes contaminated if exposed to outside odors. It will readily be understood why extreme care must be exercised in every step of its production, storage, transportation and refining. On arrival at the discharging port of the United States, preparations started while the oil was enroute begin to function. The first procedure is to take samples from each tank and subject them to rigid laboratory analyses to determine whether the quality has been impaired during its long journey. Satisfied on this point, the oil is pumped into scales to determine the landed weights, and then into tankcars or tankbarges for shipment to its purchasers.

Some large coconut oil operators, located on seaboard, have the ships discharge at their own plants, and after weighing the oil, pump it directly into their storage tanks and hold it subject to the call of the trade.

The Oil Mill Industry In Modern Germany

A Current Review of the Vegetable Oil Industry of the Republic, Including Comparison with Prewar Conditions

By Coke S. Rice*
Vice Consul at Hamburg

Part II

PEANUTS rank as second in importance of all oil-bearing materials imported. India supplies over two-thirds of the imports, with British West Africa, French West Africa, and China following. Imports from the United States are negligible, the high price of the American product excluding it from the German market. Imports have steadily increased, until in 1929 the total was nearly seven times the quantity imported in 1913.

Production of peanut oil has shown a decided increase, the 1929 figure being nearly seven times the quantity produced in 1913. The chief cause is the increase in local consumption. Peanut oil has a decided advantage over other vegetable oils in that when produced from clean nuts it need not be refined, for some edible purposes.

Imports are very small, with the Netherlands supplying the largest percentage. There is an import duty of 2.50 marks per 100 kilos ($0.27 per 100 pounds) when imported in barrels and 20-22 percent when imported in other containers. Exports have shown a steady and consistent increase. In 1929 the total tonnage was over three times that of 1913 and nearly five times the total for 1926. The increased capacity of the mills has made it possible to supply the growing requirements of the home market and have a comfortable margin for export. In 1913 exports were equal to 42.2 percent of the total production and last year represented approximately 20 percent.

Domestic Consumption has increased. In 1929 the total consumed was nearly nine times that of 1923, owing to the increased consumption of margarine. Of the total production and imports 80 percent was used in the manufacture of margarine.

There are no figures showing the import and export of peanut cake and meal for the years, 1926 to 1928 inclusive. However, the figures for 1929, show that Germany imported 143,545 metric tons, India, Italy, France, Argentina, and the Netherlands being the principal suppliers and exported 133,692 metric tons, Denmark and the Netherlands being the chief buyers. The greater part of the domestically produced peanut cake and meal is consumed locally. It is being used extensively in the cattle raising industry and should continue to show an increase in consumption.

The price of crude peanut oil in 1929 reached new low levels, by reason of the large harvest of peanuts and the low level reached by all oils and fats. It was said that the price for peanuts was disastrous for the growers, but 1930 has set new low levels, with no indication of a decided improvement. Present prices are the lowest in 20 years. In fact, of late, the market has suffered severe reverses, and buyers are purchasing only for actual requirements. This is another reflection of the effect of the present grain prices, and in addition peanut oil is suffering owing to the present price of whale oil.

Sesame Seed and Oil

China, Africa, and India are the principal sources of supply, with China supplying the largest percentage. Sesame seed imported before the war was far in excess of that imported recently, owing mainly to the repeal of a law requiring that margarine products contain 15 percent of sesame oil.

The Belgian Congo and Mozambique have recently entered the market as suppliers of sesame seed. Imports for 1927 decreased in quantity, mainly because of the high price of

*Report to Foodstuffs Division, Dept. of Commerce. Published by Special Permission.

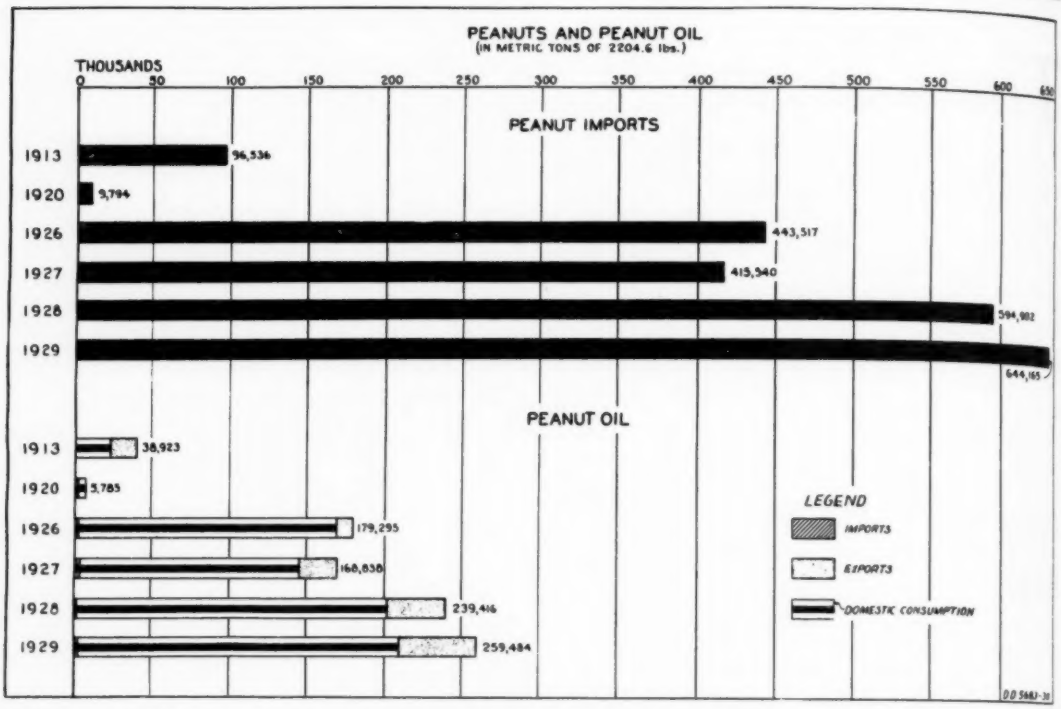


Chart showing German imports of peanuts, also imports, exports and domestic consumption of peanut oil, in selected years from 1913 to 1929

sesame seed, which was replaced by other oil-bearing seeds. Exports of this seed are negligible, as the imports are for domestic use in the production of sesame oil.

The production of sesame oil has decreased nearly 90 percent since 1913, as it is no longer required as an ingredient in margarine. Recent years show a fairly steady increase. Imports, although at no time considerable, also decreased to a point where they are negligible. The duty on sesame oil is 2.50 marks per 100 kilos ($0.27 per 100 pounds) in barrels and in other containers, 22 percent. Exports, on the other hand, have shown a decided increase. The industry is in better position at present to supply foreign demands than for some years. The Netherlands is the chief purchaser. Judging from statistics for the first six months of 1930, exports for this year will be far in excess of 1929, as the total for these months is greater than the total for the whole year of 1929.

Soy Beans

IN KEEPING with its conquest of the other world markets, the soy bean has made rapid strides in Germany. Almost, one might say, a negligible factor in the vegetable oil industry in 1913, it has risen to a place of first importance, the total imports for 1929 being almost twice those of any of the other raw products and almost 50 percent of the total imports of raw oleaginous products. Imports were of such minor importance in 1913 and 1920 as to be classified with other miscellaneous oil-bearing seeds and nuts.

The entire supply for Germany comes from Northern Manchuria, but as Russia has made extensive plans for growing soy beans, there is every reason to expect that that country will enter the market at some future date. The following table shows the quantities of soy beans imported into Germany for the years 1913, 1920, and 1926 to 1929, inclusive. From this it will be seen that imports in 1929 were almost ten times those of 1913. The export of this product is not of particular importance since nearly all of it is imported for domestic use for the production of oil and cake.

SOY BEAN IMPORTS FROM CHINA
(metric tons)

1913	1920	1926	1927	1928	1929
106,066	18,366	370,038	576,096	847,723	1,023,858

In Germany soy bean oil is used mainly in the manufacture of margarine, 71 per cent of the home consumption being used by margarine factories. Total production for 1929 was over seven times the production for 1913 and nearly three times the production for 1926. Imports have steadily decreased during the past four years and are of no particular impor-

tance. The import duty is 2.50 marks per 100 kilos, in barrels ($0.27 per 100 pounds) and 20 to 22 percent in other containers.

The quantity exported as compared with the domestic production has increased from 5 percent in 1913 to 30 percent in 1929, practically every European nation participating in the purchases, with the Netherlands in the lead followed by Danzig and Austria. The United States, was not a purchaser during 1926 and 1927, but entered the market in 1928, with a considerable increase in 1929. However, the German producers depend mainly on the European market as an outlet. Great Britain, which in 1926 and 1927 did not purchase any oil from Germany, entered the market in 1928 and 1929. This is particularly interesting, in view of the fact that the first soy beans imported into Europe were shipped to England, about 20 years ago.

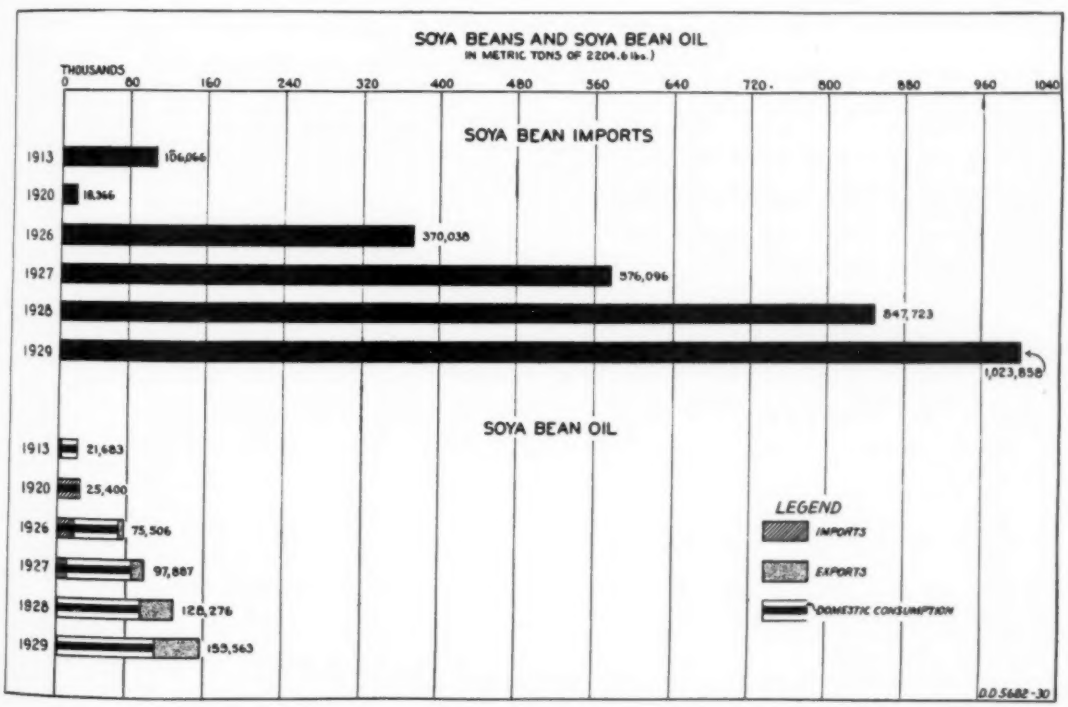
While the consumption of soy bean oil in Germany increased about 50 percent since 1926, the percentage as compared to production decreased. In 1913 local consumption was greater than local production. Domestic consumption for other years was: 1917, 34 percent; 1928, 74 percent. This is evidence of the ability of local mills to take care of local demand and at the same time provide exports.

There are no figures available showing the imports and exports of soy bean meal and cake, with the exception of 1929, when 26,715 metric tons were imported, mostly from Italy and China, as against 185,826 metric tons exported, with Denmark, the Netherlands, and Finland taking the principal share, followed by Sweden and the United States. The domestic consumption of soy bean cake and meal in Germany has increased steadily, and there is every reason to believe that it will increase more and more in the future. A continual propaganda is being carried on to induce the farmers to use more soy cake with other oil cakes as a cattle feed, while campaigns are being waged by the millers to popularize soy bean meal as a substitute for flour in the manufacture of bread.

Soy bean oil has followed the trend of other oils, prices for 1929 being uniformly low. With the present market condition there is very little prospect that there will be a favorable reaction in the near future.

Castor Oil

WHILE there is quite a large quantity of castor oil produced locally by plants in Hamburg, Bremen, Harburg, and Stettin, no production statistics are available. Imports re-



German trade in soya beans and soya bean oil in typical years selected between 1913 *and* 1929

mained steady, with little change from pre-war figures. Russia in 1929 entered the field as an exporter and may play an important part in the future. Imports come principally from Belgium and Great Britain. The import duty is from 4 to 8 marks for 100 kilos (approximately $0.43 to $0.84 per 100 pounds.) Exports are negligible, as the quantities produced and imported are mainly for local consumption. The use of castor oil as a lubricant for airplane motors has helped to keep the market on a fairly steady level, as well as returning fair prices.

Olive Oil

ALL olive oil is imported, there being no domestic production. The amount exported is small. The imported oil is almost exclusively for domestic use; for technical purposes in the manufacture of yarns and for table use as a salad oil. The import duty is 10 marks per 100 kilos, ($1.08 approximately per 100 pounds), for edible, inedible is free.

France and Italy furnish equally most of the oil.

Palm Oil

ALL palm oil is imported mainly from the country of origin. Imported edible oil must be used under supervision of a government official and bears a duty of 1.75 marks per 100 kilos ($0.19 per 100 pounds). There is no duty on inedible oil. In Germany palm oil is used mainly in the manufacture of hard and soft soaps, its use for edible purposes being limited. Exports are of little importance, showing a steady decline during the years under consideration.

Fish, Seal and Whale Oils

IN Germany, whale oil is the most important of the three oils—fish, seal, and whale, comprising nearly 16 percent of the fats used in the margarine industry. Practically all whale oil imported is hardened in the plant at Brake. The other oils are of no particular importance. In 1913 imports of these oils comprised over 50 percent of the total imports of foreign oils, and increased to 67 percent last year. There is no duty on these oils not hardened. Czechoslovakia and the United States are the largest purchasers of the exports.

Summary of Imports

IMPORTS of oleaginous raw materials for 1929 were more than double those for 1913 and 74 percent greater than in 1926. Soy beans showed the greatest increase, followed by peanuts, these two items representing over two-thirds of the total. In constrast to the increase in the importations of all other products listed, the decrease in imports of cotton seed and sesame seed is noticeable.

IMPORTS OF OLEAGINOUS RAW MATERIALS

	1913 Tons	1920 Tons	1926 Tons	1927 Tons	1928 Tons	1929 Tons
Copra	193,492	95,362	198,715	187,470	200.759	24,547
Cottonseed	219,797	513	30,337	33,012	7,011	7,374
Palm:						
Kernels	232,194	26,803	238,595	273,716	297,367	304,475
Peanuts	96,536	9,794	443,517	415,450	594,902	644,165
Sesame seed	114,205	24,594	7,503	4,813	8,718	13,793
Soy beans	106,066	18,366	370,038	576,096	847,723	1,023,858
Total:	962,290	175,432	1,288,705	1,490,557	1,956,480	2,238,212
Imports from:						
British East Africa			21,328	19,595	18,840	12,230
British West Africa			224,881	243,346	246,555	268,718
British South Africa			2,193	897	—	1,574
French West Africa			93,930	75,643	53,083	53,577
Mozambique			1,740	9,406	5,406	5,272
Cameroon			4,515	4,865	1,468	2,683
Belgian Congo			59,986	71,348	84,966	82,529
Liberia			3,390	1,906	1,438	536
Togoland			2,710	1,988	728	93
Egypt			25,276	31,354	4,064	7,139
Ceylon			15,461	11,715	4,505	9,934
China			419,444	600,538	863,326	1,047,225
India			229,881	249,383	468,776	507,262
Netherland Indies			161,311	162,241	185,454	213,811
Philippines			648	—	—	—
Samoa			1,606	2,865	1,211	998
Straits Settlements			7,567	10,329	3,524	8,208
United States			5,423	803	2,511	259
Angola			3,813	881	5,104	2,630

(*To be continued*)

Twenty-second Annual Oil Chemists' Meeting

New Orleans Again Selected for Gathering of Fat and Oil Scientists and Technologists in May

PLANS are progressing rapidly for the Twenty-second Annual Meeting of The American Oil Chemists' Society, which will be held at the Roosevelt Hotel, New Orleans, Thursday and Friday, May 14th and 15th.

W. H. Irwin

President W. H. Irwin has announced that many matters of great importance to the society and to the members will be brought up for discussion at the meeting, including recommendations in regard to the form of meeting, procedure for the adoption of Official Methods, and other matters of importance to the future growth of the society. Every member is urged to make every effort to attend the meeting and take advantage of the many benefits to be derived from the scientific papers and committee reports to be presented as well as from the opportunities for social contacts with his fellow members.

Send in your reservations for hotel accommodations to the Hotel Roosevelt, attention Mr. Franklin Moore, Vice President, at once, if you have not already done so. The Roosevelt will be Convention Headquarters, and the management, in addition to providing meeting rooms for the Society without charge, is making special rates for members, and will exert special effort to make you comfortable during your visit to New Orleans.

The entertainment features in connection with the meeting will be in charge of the New Orleans Local Arrangements Committee, under the Chairmanship of E. G. Williams, who has served so capably in this capacity in former years. The Annual Banquet will be a notable occasion, and the Golf Tournament will, of course, bring out many enthusiastic competitors for the Nuchar Challenge Cup and many other beautiful prizes, donated by other friends.

The Challenge Cup has been in competition for two years, having been won first by E. R. Barrow and second by his partner, G. Worthen Agee, both of Memphis, Tennessee. For permanent possession of the cup by any member, it must be won by him three times, not necessarily in succession, and many aspirants, headed by Vollertsen, Hamner, Fash and Irwin, are determined that the cup will not find a home in a certain Memphis laboratory for a third year.

The Golf Tournament Committee, Messrs. Vollertsen, Trevithick and Hamner, Chairman, announce an imposing array of prizes, including a medal for the year's winner of the Challenge Cup, a Gladstone bag, golf balls, golf clubs, chemical slide rule, and many others.

The tentative program for the meeting follows. There will be several additions of scientific papers, which will be announced in our next issue.

Preliminary Program of the

TWENTY-SECOND ANNUAL MEETING OF THE AMERICAN OIL CHEMISTS' SOCIETY

Roosevelt Hotel
New Orleans, La., May 14-15, 1931

President

W. H. Irwin, Chicago, Ill.

Vice Presidents

A. S. Richardson, Cincinnati, Ohio; M. M. Durkee, Decatur, Illinois; L. B. Forbes, Little Rock, Arkansas; A. Campbell, Cincinnati, Ohio.

Secretary-Treasurer

J. C. P. Helm, New Orleans, La.; W. A. Peterson, Sec'y Soap Section, Brooklyn, N. Y.

Official Journal
OIL AND FAT INDUSTRIES
Alan Porter Lee, Editor
SOAP—(for soap section)

Editorial Advisory Board

A. D. Holmes, G. S. Jamieson, H. J. Morrison, Claude E. McLean, A. W. Putland, W. D. Richardson, Maximilian Toch, H. P. Trevithick, David Wesson, H. Aspegren.

Governing Committee

W. H. Irwin, *Chairman*; A. S. Richardson, M. M.

Durkee, L. B. Forbes, A. Campbell, W. R. Stryker, A. W. Putland, R. H. Fash, H. P. Trevithick.

Referee Board

W. H. Irwin, *Chairman*; Felix Paquin, L. C. Haskell, H. Aspegren, W. R. Stryker.

PROGRAM

Thursday, May 14, 1931
Convention called to order at 9:30 A. M.
E. G. Williams
Chairman Local Arrangements Committee
* * *
Invocation
* * *
Opening of Twenty-second Annual Meeting
* * *
Reading of Minutes of Last Annual Meeting
J. C. P. Helm
* * *
Address of President
W. H. Irwin
Report of Secretary-Treasurer
J. C. P. Helm

PROGRAM

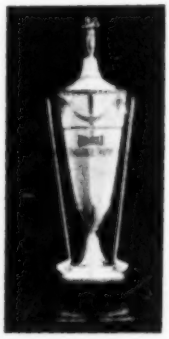
Report of Governing Committee
J. C. P. Helm, Secretary
Report of Membership Committee
A. S. Richardson, Chairman
Report of Sampling Committee
C. V. Serbell, Chairman
Report of Committee on Solvents
R. H. Fash, Chairman
Report of Cottonseed Analysis Committee
C. H. Cox, Chairman
Report of Crude Mill Operations Committee
A. K. Schwartz, Chairman
Report of Color Committee
W. D. Hutchins, Chairman
Report of Refining Committee
C. B. Cluff, Chairman
Zapote (Mammy Apple) Seed and Oil
G. S. Jamieson
At this period there will be a general discussion on Methods with the Chemists' Committee of the National Cottonseed Products Association.
T. C. Law, Chairman
Appointment of Special Committees
Announcements
Adjournment until 9:30 A. M., Friday

PROGRAM

Friday, May 15, 1931
Report of Soap Section
A. Campbell, General Chairman
Report of Soap Committee
H. P. Trevithick, Chairman
Report of Glycerine Committee
J. T. R. Andrews, Chairman
Isolation of Compounds Giving Rise to Kreis Color Reaction.
L. B. Kilgore
Rancidity of Oil and the Problem of Mayonnaise Spoilage.
A. S. Richardson and E. W. Eckey
Report of Kreis Test Committee
A. S. Richardson, Chairman
Report of Fat Analysis Committee
W. D. Richardson, Chairman
Report of Moisture Committee
N. C. Hamner, Chairman
Report of Committee on Basic Research
E. R. Barrow, Chairman
Referee Board Report
W. H. Irwin, Chairman

PROGRAM

Report of Olive Oil Committee
M. F. Lauro, Chairman
Report of Smalley Foundation
A. W. Putland, Chairman
Report of Committee on Publication of Methods
W. H. Irwin
Report of Planning and Uniform Methods Committee
J. J. Vollertsen, Chairman
Reports of Special Convention Committees
Miscellaneous Business
Report of Nominating Committee
Election of Officers
Adjournment.



Golf Tournament Challenge Cup

Two interesting patents recently issued covering the production and processing of linseed oil are U. S. Pat. Nos. 1,790,494 and 1,790,514. The first refers to the recovery of linseed oil from flaxseed, the whole uncracked flaxseed being cleaned to a maximum of about 1.5% dockage and the oil pressed out at a temperature not exceeding 43°. The second patent contemplates bleaching of linseed oil free from mucilaginous matter by heating to 260-282° *in vacuo* in the presence of steam and then rapidly chilling to about 95°.

Lecithin Retards Hydrolysis of Fats*

Removal of Nitrogeneous Body Found to Accelerate Saponification Rate in Twitchell Treatments

By Ralf B. Trusler

MODERN technology of the treatment of fats and fatty oils for the production of fatty acids is chiefly the composite result of practical experiments, many of which were done upon a commercial scale. The treatment of fatty oils by the catalytic process of hydrolysis has therefore resulted in a rather universal method based upon accrued experience.

The commercial production of a fatty acid from a fat or a fatty oil is most frequently accomplished by splitting the fat by means of a catalyst, that most commonly used being known as Twitchell reagent. This is done by reacting one part by weight of the fat with from one to two parts by weight of water in the presence of 1 to 1½% (on the basis of the fat) of the catalyst, while the mixture is kept hot and thoroughly stirred.

Not all fats and fatty oils were found to react with the same ease, and if any uniformity of procedure and product was to be obtained it became necessary to wash the fat with about 5% to 7% of a moderately concentrated solution of sulfuric acid. This concentration may be in the neighborhood of 20% which is too dilute either to sulfate or to sulfonate the olefine acids. The sludge from the acid wash is drained off before the next step of splitting is begun, which is generally done in a separate chamber. Upon most occasions a small amount of sulfuric acid is added to the mixture of catalyst, fat and water as a further aid to splitting. The literature reveals an occasional idea why the sulfuric acid treatment is necessary, while about the plants the thought persists that this is some sort of necessary purification.

During a laboratory study of catalytic splitting of fats, it was observed that glycerides from various sources behaved in different manners. If the fats or fatty oils were given an energetic pre-treatment with the sulfuric acid solution, the difference in the hourly rate of hydrolysis and time required for a 90% to 95% split became less marked, but if the sulfuric acid in treatment was omitted no two fats responded alike to the process of splitting. When reactions were brought about between a fat and water aided only by 1½% to 3% of catalyst it was found that lard and tallow were subject to considerable amount of splitting and that from ten to eighteen hours treatment at 90° to 95° sufficed to produce approximately 90% free fatty acid. In contrast to this, a similar experiment conducted upon crude cottonseed oil and soy bean oil ended with little or no change for similar treatment.

This vast difference in behavior of these fatty compounds cannot be attributed merely to animal or plant origin, or to the difference in the compositions of the glycerides, because similar peculiarities were found in oils of both sources. The explanation for this difference seemed either to be the presence of a small amount of some compound in lard, in one instance, that aided hydrolysis, or the presence of a substance in cottonseed oil for example, that inhibited the decomposition of the fatty oil. Since lard is a relatively pure glyceride and crude cotton seed oil is known to carry small amounts of compounds other than glycerides of fatty acids, it was naturally suspected that the resistance of a fatty oil to hydrolysis must be dependent upon some sort of compound we may call an antihydrol.

The presence of an antihydrol was established in an indirect way. First of all, if such a body were present, in a fat or fatty oil, the fat should respond to splitting with the ease of lard if this compound were removed or destroyed. The removal of a compound that miyht be present only to the extent of about 0.1 to 0.25% did not appear as promising as some means for destroying it. Long heating had some effect in reducing the resistance to

*Presented at Fall Meeting American Oil Chemists Society, Chicago, Nov. 14, 1930.

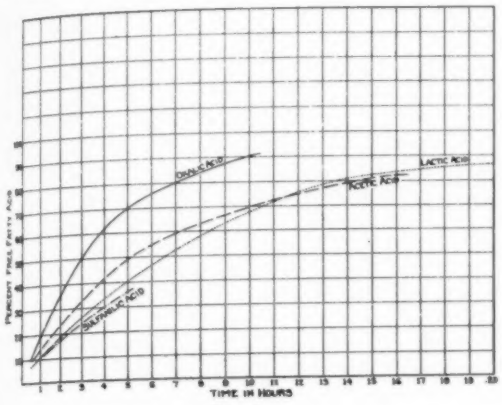


Fig. 1

hydrolysis. Chemical means were found the most efficient. If the oil was treated with from 1% to 3% of strong hydrochloric acid solution or with about 3% to 5% of a 20% sulfuric acid solution, preferably during heating, and thoroughly washed to remove all mineral acid afterward, hydrolysis could then be accomplished by the catalyst alone without difficulty.

Inasmuch as the relative sensitivities of treated and untreated oils could best be determined by splitting the fats under identical conditions and then by comparing curves for time of treatment plotted against degree of split, it became necessary to select a method capable of giving uniform results. A few runs in which lard was used as the fat to be hydrolyzed, revealed that considerable variation occurred when the catalyst was used without an additional acidulant. If about 1% of sulfuric acid was added to the reactants (based upon the weight of lard) a uniform set of reactions would be obtained, but this was not applicable to cottonseed oil and other kinds of resistant oils because mineral acids decomposed the protecting bodies. However, an experiment in which lard was hydrolyzed by the Twitchell catalyst in the presence of an organic acid showed that definite aid was obtain from this acidulant, and a similar experiment upon cottonseed oil gave the same result as if the acidulant had not been present. In other words, the stabilizing body present in cottonseed oil was not decomposed by the organic acid acidulant. Only mineral acids or compounds capable of liberating mineral acids appeared to have the ability to render the antihydrol inactive.

Experimental Results

A SERIES of fat splitting experiments was conducted upon lard to note the relative value of various organic acids as an aid to the Twitchell catalyst so that the most active compound might be selected for pursuing this investigation. The reaction mixtures consisted of 450 grams of pure lard, 675 g. distilled water, 4.5 g. Twitchell reagent and such a quantity of an organic acid that the available carboxyl groups would be comparable to those in 4.5 grams of oxalic acid, which was taken as the standard for comparison. Each reaction mixture was constantly stirred and kept heated in an oil bath at 95° while the water content was kept fairly constant. In this manner a comparison was obtained between acetic, lactic, oxalic and sulfanilic acids. Curves for these runs are shown in Figure 1. It is apparent that oxalic acid is very good aid to the catalyst. Acidity, or degree of ionization can hardly be the cause for the difference between these acids because of their large dilution.

A number of fats and fatty oils including lard, yellow grease, chicken fat (body), menhaden oil, cod liver oil, palm oil, palm kernel oil, coconut oil, soy bean oil and cottonseed oil, were subjected to a similar treatment in which 450 g. of the fat, 675 g. of water, 4.5 g. Twitchell reagent and 4.5 g. oxalic acid were used. The reactions were all carried out at 95° and the rate of splitting was determined by taking small samples for fatty acid determinations at frequent intervals. These experiments showed that fats used for storage purposes such as lard, tallow, palm oil, etc. hydrolized with varying degrees of ease, while fats pressed from glands, such as cod liver oil, and from seeds containing the seed germ, most generally resisted hydrolysis under the same conditions. There were some moderate exceptions. A few curves showing this difference in rate of hydrolysis appear in Fig. 2.

An examination of the fatty oils that resisted hydrolysis revealed that they contained pre-

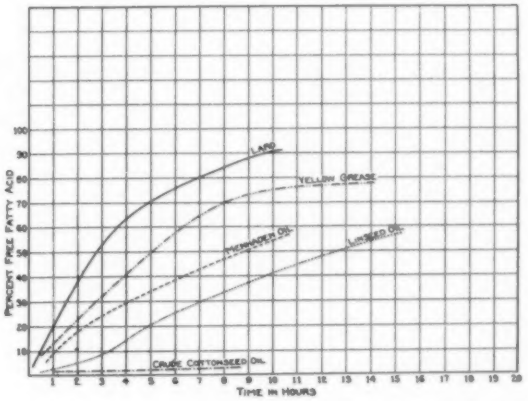


Fig. 2

(*Turn to p.* 157)

A Useful Horizontal Tank Chart

By W. F. SCHAPHORST

THE accompanying chart gives the number of gallons of liquid in any horizontal tank without the use of tables, formulas, figures, or computations of any kind.

Simply start at the left and zigzag a ruler or thread across the chart three times as demonstrated by the dotted line and the number of gallons is immediately found in column *G*.

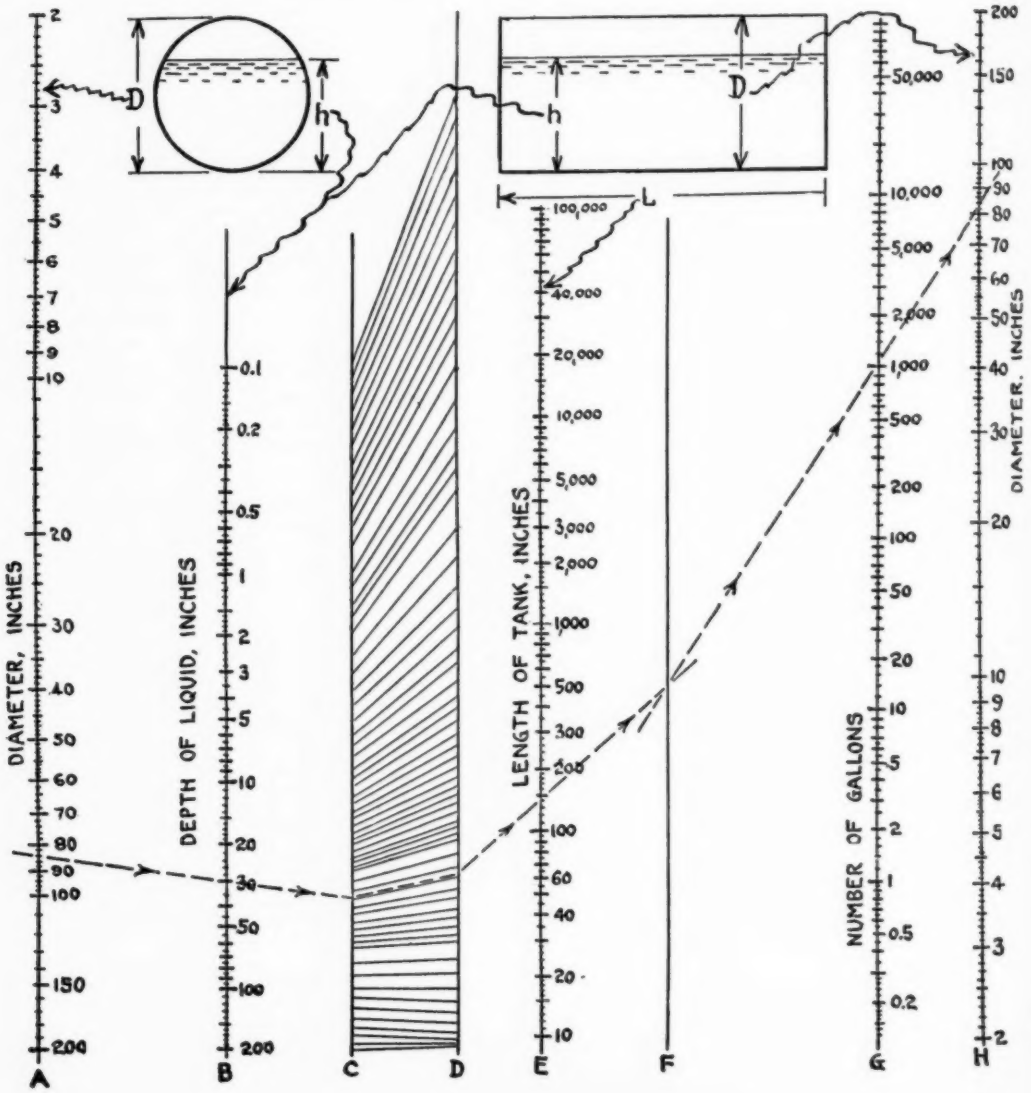
For example: How many gallons in a tank 84 inches in diameter, the depth of liquid being 30 inches and the length of the tank 142 inches?

Run a straight line through the 84 in column *A* and the 30 in column *B* and locate the intersection with column *C*. Follow the radiating guide lines to column *D*, locating a second point of intersection. From this intersection run through the 142, column *E*, and locate the point of intersection in column *F*. Then from this point run over to the 84 column *H*, and the intersection in column *G* will be found to be close to 1050 gallons, which is the answer.

To make the chart absolutely clear sketches show the diameter of the tank, *D*, the depth of liquid, *h*, and the length of tank, *L*, with wavy arrows leading from them to the proper columns.

This chart takes care of any depth of liquid from 0.1 inch to the full capacity of the tank, any diameter from 2 to 200 inches, and any length of tank from 10 to 100,000 inches. It will give an answer much more quickly than tables or formulas. It is surprisingly accurate. It is more complete than tables because it takes care of every dimension between 2 to 200 inches, whereas tables generally skip many diameters and lengths.

Since column *E* takes care of lengths of tanks up to 100,000 inches, this chart can also be used to compute either the full or the partial capacity of long pipes. Inversely the chart may be used for determining the length of tank necessary to hold a given number of gallons where the diameter of tank and depth of liquid are known or fixed quantities.



Margarine Taxation Made More Burdensome

Congressional Efforts to Favor Farmers Result in Increased Levy on Wholesome, Economical Food Product

THE Seventy-first Congress has crowned the efforts of its remarkable Third Session by the passage of an act designed to tax out of existence the manufacture of naturally colored margarine. The measure encountered very little opposition in committee, and even less in the Halls of Congress, doubtless because every member believed that its passage would gain the friendship of the agricultural portion of the population.

The resulting effect upon the manufacture of margarine and upon its cost to the consumer remains to be determined. The provisions of the act are somewhat loose and ambiguous, leaving the determination of what constitutes yellow margarine in the hands of the Bureau of Internal Revenue, which can undoubtedly construe the legislation in such a manner as to apply the increased tax of 10 cents per pound to all margarine, if inclined to do so. The full text of the measure as passed is as follows:

[PUBLIC—No. 867—71ST CONGRESS]

[H. R. 16836]

An Act To amend the Act entitled "An Act defining butter, also imposing a tax upon and regulating the manufacture, sale, importation, and exportation of oleomargarine," approved August 2, 1886, as amended, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the second paragraph of section 3 of the Act entitled "An Act defining butter, also imposing a tax upon and regulating the manufacture, sale, importation, and exportation of oleomargarine," approved August 2, 1886, as amended (U. S. C., title 26, sec. 207), is amended to read as follows:

"And any person that sells, vends, or furnishes oleomargarine for the use and consumption of others, except to his own family table without compensation, who shall add to or mix with such oleomargarine any substance which causes such oleomargarine to be yellow in color, determined as provided in subsection (b) of section 8, shall also be held to be a manufacturer of oleomargarine within the meaning of this Act and subject to the provisions thereof."

SEC. 2. Section 8 of such Act of August 2, 1886, as amended (U. S. C., title 26, sec. 546), is amended to read as follows:

"SEC. 8. (a) Upon oleomargarine which shall be manufactured and sold, or removed for consumption or use, there shall be assessed and collected a tax at the rate of one fourth of 1 cent per pound, to be paid by the manufacturer thereof; except that such tax shall be at the rate of 10 cents per pound in the case of oleomargarine which is yellow in color.

"(b) For the purposes of subsection (a) and of section 3, oleomargarine shall be held to be yellow in color when it has a tint or shade containing more than one and six-tenths degrees of yellow, or of yellow and red collectively, but with an excess of yellow over red, measured in the terms of the Lovibond tintometer scale or its equivalent. Such measurements shall be made under regulations prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, and such regulations shall provide that the measurements shall be applied in such manner and under such conditions as will, in the opinion of the commissioner, insure as nearly as practicable that the result of the measurement will show the color of the oleomargarine under the conditions under which it is customarily offered for sale to the consumer.

"(c) The tax levied by this section shall be represented by coupon stamps; and the provisions of existing laws governing the engraving, issue, sale, accountability, effacement, and destruction of stamps relating to tobacco and snuff, as far as applicable, are hereby made to apply to stamps provided for by this section."

SEC. 3. That section 15 of the Agricultural Marketing Act, approved June 15, 1929, is amended by adding at the end thereof a new subdivision to read as follows:

"(g) As used in this Act, the term 'agricultural commodity' includes, in addition to other agricultural commodities, crude gum (oleoresin) from a living tree, and the following products as processed by the original producer

(*Turn to p.* 157)

Factory Consumption of Fats and Oils by Industries

THE Bureau of the Census of the Department of Commerce has just initiated publication of a summary by industries of the factory consumption of oils, fats and greases in the United States. This valuable summary indicates that the soap industry is the largest consumer of oleaginous materials with the shortening industry ranking a close second. The leading three total consumptions in 1929 were: soap, 800,000 tons, shortening and allied products 700,000 tons, paint, varnish and enamels 225,000 tons.

The following tabular statement compiled from the quarterly reports for 1929 shows for eight specific industries and a group of miscellaneous industries the consumption of the several primary animal and vegetable fats and oils. It should be noted that consumption as here referred to embraces only that of factories which use these materials in the production of other fat and oil products, and products of which they form a constituent part, in addition to the tin plate, textile and leather industries, the products of which do not contain or retain any considerable portion of the fats and oils used as agents in their manufacture.

The total consumption in all industries for each item is the same as given in the bulletin for 1929 except for those vegetable oils for which the crude and refined products are indicated in the regular reports, viz.: cotton seed, coconut, corn, peanut, palm-kernel and soy bean oils. For each of these a net consumption was arrived at by deducting from the total of both crude and refined consumed the amount of refined produced, and the loss in refining, considered as having its equivalent in the foots used in soap manufacture, was placed as primary oil used by that industry.

In some cases, where the operations of individual factories as reported covered two or more of the specified industries, it was necessary to segregate the quantities for a number of items in accord with such information as was available. However, it is believed that the statistics as presented closely approximate the facts.

In some of the headings only the predominant products of the industry are mentioned. For instance, "Shortenings" includes mayonnaise, salad oils and other similar food products except margarine, which is shown separately as reported by the Bureau of Internal Revenue; "Paint and varnish", enamels, lead grinding, etc.; "Linoleum and oil cloth", other coated fabrics; and "Textiles", the operations of some of the producers of special oils and soaps used in that industry.

Factory Consumption of Animal and Vegetable Fats and Oils, by Industries: 1929.

(Quantities in thousands of pounds)

	All Industries	"Shortenings"	Margarine	Soap	Paint and Varnish	Printers Ink	Linoleum and Oil Cloth	Textiles	Miscellaneous Industries
Total..	4,197,175	1,396,881	300,560	1,618,953	452,207	24,950	133,018	19,100	251,506
Cottonseed oil	1,372,295	1,161,848	30,173	167,033	96	12	—	3	13,130
Peanut oil	11,851	3,586	6,306	1,667	—	—	—	43	249
Coconut oil	652,617	72,145	185,507	393,914	—	—	—	49	1,002
Corn oil	56,755	25,459	—	25,602	364	—	—	46	5,284
Soya-bean oil	17,903	82	11	6,396	5,815	71	3,229	267	2,032
Olive oil, edible	2,067	—	—	23	—	—	—	—	2,044
Olive oil, inedible	5,858	—	—	2,375	—	—	—	2,508	975
Sulphur oil or olive foots	38,875	—	—	38,448	—	—	—	262	165
Palm-kernel oil	56,598	11,824	1	44,532	—	—	—	179	62
Rapeseed oil	13,327	138	—	132	95	—	—	148	12,814
Linseed oil	501,235	—	—	1,916	340,166	23,894	112,855	161	22,243
Chinawood oil	97,474	—	—	—	88,386	437	5,963	17	2,671
Vegetable tallow	8,470	—	—	8,404	—	—	—	42	24
Castor oil	28,835	—	—	3,730	3,287	36	522	13,115	8,145
Palm oil	198,017	1,191	1,523	178,851	—	7	7	540	*15,898
Sesame oil	10,076	5,215	—	4,835	—	—	—	2	24
Perilla oil	2,639	—	—	—	2,573	10	—	—	56
Other vegetable oils	2,558	102	29	1,714	240	—	301	—	172
Lard	45,869	23,123	22,628	—	—	—	—	—	118
Edible animal stearin	52,245	44,138	6,135	303	—	—	—	—	1,469
Oleo oil	56,360	7,553	48,226	339	17	37	—	1	187
Tallow, edible	28,452	25,556	21	1,782	—	9	—	—	1,084
Tallow, inedible	514,755	—	—	451,835	42	6	—	1,351	61,521
Grease	227,612	—	—	154,288	524	381	—	344	72,075
Neat's foot oil	6,330	—	—	—	—	—	—	21	6,309
Fish oils	188,102	14,921	—	130,634	10,672	50	10,141	1	21,753

* Includes 15,512 thousand reported by the tin and terne plate industry.

Notes of the Industry

Report Fat and Oil Research

At the 81st meeting of the American Chemical Society, held at Indianapolis March 30 to April 3, papers were read before the Division of Agricultural and Food Chemistry treating upon the following subjects of interest to chemists and technologists dealing with fats and oils:

Effect of Certain Feeds for Dairy Cows upon some of the Physical and Chemical Characteristics of Milk Fat, by O. R. Overman and O. F. Garrett; The Van Slyke Method for Protein Analysis as Affected by Fat, by S. M. Hauge; A New Method of Determining Aldehydes as a Measure of Oxidation in Fats and Oils, by H. Schibsted; Residual Current Measurements as a Control for Metal Solution in Milk, by H. T. Gebhart and H. H. Sommer; The Soy Bean as Human Food, by A. A. Horvath; The Nutritive Value of Soy Beans. The Effect of Heating, by C. L. Shrewsbury; The pH of Butter as Related to Titratable Acidity, by B. H. Nissen; The Boiling Points, Specific Gravities, and Refractive Indices of Ethylene-Dichloride-Carbon Tetrachloride Mixtures, by O. A. Nelson and H. D. Young.

El Dorado Oil Works, of San Francisco, announce plans for a new copra crushing plant to be located on deep water in the harbor. The new location was selected with a view to the reduction of production costs through more economical handling of raw materials.

A recent ruling of the Federal Court of Customs Appeals declares that a mixture of fatty acids, constituting a product something like stearic acid, is dutiable at 25%, as an acid not especially provided for, instead of as stearic acid, which was the contention of the importers, because of the product's similarity to that acid.

Philip O. Schleussner, first vice president of Roessler & Hasslacher Chemical Co., and an active figure in the chemical industry during the past twenty-five years, died of bronchial pneumonia on March 21, at his home in Stamford, Connecticut, in his fifty-fourth year.

Develop New Drum Inspector

Kollmorgen Optical Co., 761 Wythe Ave., Brooklyn, manufacturers of lenses and other optical instruments, have developed a device for use in examining the interiors of bung type drums and barrels. It is being marketed as the "Tankoscope." The drum inspector weighs 2½ pounds, can be inserted through a 1¼ inch hole to a depth of 30 inches and is equipped with a gas filled lamp which enables the user to examine thoroughly the interior of the container. The lamp is protected by a heavy guard which may be removed for cleaning or for renewing the lamp. The "Tankoscope" is built on the principle of a periscope, which the company has been manufacturing for submarines for several years. It is finished in corrosion-resisting chromium plate. The illustration shows the "Tankoscope" in actual use.

The Trade Practice Committee of the Mayonnaise Manufacturers Association announces through the Executive Manager of the association that the committee will meet with manufacturers of mayonnaise, whether members of the association or others, anywhere in the United States, for discussion of adjustment of harmful trade practices and means of their amelioration.

The United States Tariff Commission announces an investigation and impending public hearing upon the production costs and other conditions affecting inedible gelatin and glue. The date of the public hearing will be fixed in the near future.

Procter Buys Portsmouth C. O.

R. R. Deupree, president of the Procter & Gamble Co., has announced that plans have been completed for the acquisition by the Procter & Gamble Co. of the business and properties of the Portsmouth Cotton Oil Refining Corp., manufacturers of vegetable shortening and salad oils.

The Portsmouth Cotton Oil Refining Corp. has a modern refinery and manufacturing plant, occupying a 120 acre site at Portsmouth, Va., with executive and sales offices in New York. The purchase price and terms were not disclosed.

The business of the Portsmouth Cotton Oil Refining Corp. has heretofore been largely confined to the hotel, restaurant and institution fields in Eastern and Western seaboard cities. While officials of the Procter & Gamble Co. declined to make a definite statement regarding changes that might be made in the new concern, it is believed that arrangements will be made to enlarge the Portsmouth plant to take care of the manufacture of Procter & Gamble products in addition to those already being manufactured there.

Cottonseed Crushers to Meet

Plans have been completed for the Annual Convention of the National Cottonseed Products Association, to be held at the Roosevelt Hotel, New Orleans, on May 18, 19 and 20, with the Rules Committee meeting at the same place on May 15 and 16.

A record-breaking attendance is expected this year, as there will be spirited discussion of the results of the association's recently completed economic survey of the industry. The usual entertainment features will be provided, including the big golf tournament, with prizes enough for all.

A report from Commercial Attache Dye, of the Department of Commerce, stationed at Buenos Aires, states that exports of linseed from Argentina during January of this year were 222,000 tons, or about 4,000 tons less than in January, 1930.

A permit has been granted for the operation of a whaling station in Ceylon for the reduction of whales taken from the waters of the Indian Ocean. Under the terms of the permit, the operators are granted the use of the necessary Crown land under lease. The plant will be operated as one of the auxiliaries of a Norwegian whaling company.

Lever Officials Visit U. S.

With the recent arrival of several officials representing Lever Brothers, Ltd. and Unilever, Ltd., international soap and vegetable oil producers, many members of those trades in this country have been looking forward to a resumption of discussions between the Lever concerns and certain American companies looking toward a possible closer association of large interests in the soap and oil fields. Financial circles in New York, however, indicate the generally held opinion that the visit of the Lever officials presages considerable expansion of Lever Brothers Co., the American subsidiary of Lever Brothers, Ltd.

Chemical Show Tickets Available

Tickets for the Thirteenth Exposition of Chemical Industries, scheduled for Grand Central Palace, New York, the week of May 4th, may be secured at no cost from the MacNair-Dorland Co., publishers of *Oil & Fat Industries*. Your request should be sent on your company letterhead as early as possible as our supply is limited. Subscribers and advertisers will receive preference in the preliminary distribution. Announcements of exhibits indicate there will be much of interest to manufacturers and refiners of oils, fats and soaps, particularly in new machinery developments. The annual Chemical Industries Dinner, held under the auspices of the Salesmen's Association of the American Chemical Industry, which has already been set for May 7, will be an added feature of the week which many will be interested in attending.

Norwegian Whaling Notes

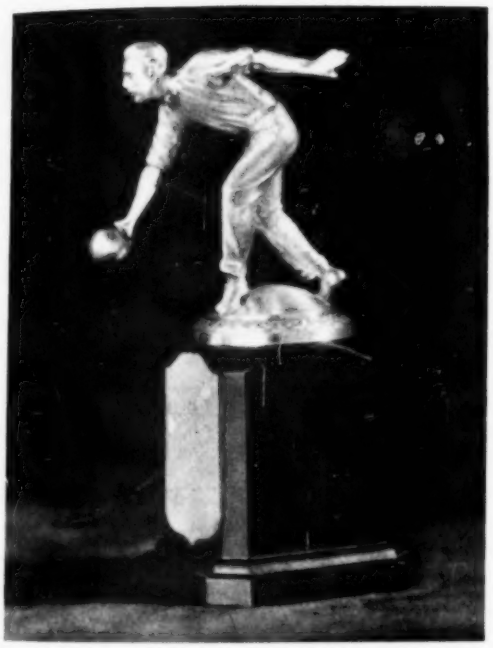
A record catch for 13 days has been reported by "Kosmos," a total of 27,000 barrels or an average of about 2,000 barrels a day, the highest known in whaling history. Restriction of whaling activities next season still continues to be a much discussed question. Some firms have already announced curtailment.

The market situation in whale oil is rather dull with some oil for this season still unsold. In late February, 1,395,000 barrels had been sold at an approximate value of $27,531,900. Various rumors that Russia might purchase 250,000 to 300,000 barrels have not been confirmed, but it will prove a great stimulus to the outlook for next season.

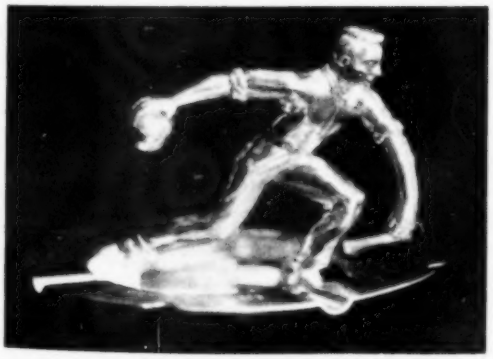
Production of whale oil by Norwegian companies up to February 22 was 1,925,050 barrels as compared with 1,324,050 barrels produced up to the same date of last season.

Chemists' Bowling Trophies

For the benefit of those members of the American Oil Chemists' Society who were unable to attend the Fourth Annual Fall Meeting in Chicago last November, we are able to illustrate herewith three of the several trophies which were awarded as prizes in the bowling tournament held as one of the entertainment features of that meeting. The Nuchar Trophy was won by the American Maize Products Co. team, the American Oil Chemists' Championship Trophy, donated by A. Daigger & Company, by the Swift and Co. Laboratory Premium team, and the high individual three game trophy by Larsen, of Corn Products Refining Co.



Nuchar Trophy, won by American Maize Products Company AMAIZOS.



Individual three game Trophy, won by Larsen, of Corn Products Refining Company.

American Oil Chemists' Championship Trophy, won by Swift Premium Team.

New Books

Margarine as a Butter Substitute. By Katharine Snodgrass. Food Research Institute, Fats and Oils Studies No. 4. 333 pages. Stanford University Press, 1930. $3.00.

In this fitting addition to the series of Studies of fats and oils of the Food Research Institute, Miss Snodgrass has contributed a most valuable treatise. In twenty-three chapters, introduction and appendix, the author has given a complete survey of the history and uses of margarine, with particular reference to the United States. The relationship of margarine manufacture and sale to the production and consumption of butter is discussed in all its aspects. The history of what amounts to persecution of the margarine industry by the dairy interests is set forth as an impartial relation of events and facts, without partisan comment. A complete review of the progress of Federal and State legislation, and an analysis of existing laws, followed by a discussion of technological developments and dietary considerations, also by a thorough economic analysis, makes this volume of undeniable value to everyone interested in margarine from any viewpoint whatever. The book is profusely illustrated with maps, charts and tables.

A. P. L.

Supplies of sesame seed are becoming more difficult to obtain at Shanghai. Prices remain high and demand from the United States is strong.

Soy bean mills in Manchuria have been much more active lately, due to an increased demand for both oil and cake from dealers and from consumers.

Margarine Materials Consumed 1925 to 1929

The consumption of materials used in the manufacture of oleomargarine in the United States for the years ended June 30, 1925 to 1929, inclusive, was as follows, according to the Department of Commerce:—

MATERIALS	POUNDS				
	1925	1926	1927	1928	1929
Oleo oil	44,102,320	47,418,248	48,740,991	45,477,089	47,184,875
Coconut oil	79,449,432	98,307,304	107,653,883	140,999,821	171,411,508
Cottonseed oil	20,965,709	25,608,341	23,372,354	24,801,238	28,173,202
Peanut oil	4,391,937	5,257,202	4,872,449	5,458,833	6,616,645
Oleo stearin	5,249,676	5,313,502	5,144,542	5,531,693	6,833,765
Neutral lard	25,673,625	25,172,425	24,871,645	25,036,262	24,189,408
Oleo stock	3,182,657	3,082,251	2,551,626	1,737,745	1,294,374
Butter	1,509,063	2,330,320	2,070,045	2,483,917	2,611,234
Milk	61,923,973	72,662,310	73,699,961	83,114,578	94,752,050
Mustard seed oil	27,181	33,645	52,603	55,947	12,000
Palm kernel oil	*346,904	*1,128,550	*639,488	*1,084,341	1,363,435
Edible tallow	110,875	93,038	218,510	69,490	25,707
Sesame oil	268,381	185,720	129,888	39,938	----
Corn oil	196,332	173,733	182,798	37,850	----
Soybean oil	----	790	32,620	150	----
Salt	18,724,864	20,592,622	21,682,525	25,024,341	27,311,180
Soda	57,994	58,657	81,893	95,806	110,715
Extract of vanilla	334	315	255	237	60
Coloring	38,155	40,763	18,043	19,464	46,519
Miscellaneous	14,367	----	68,756	----	----
Totals	266,233,779	307,459,772	316,034,875	351,068,790	410,936,577

*Stated as palm oil in 1925.

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of Oil & Fat Industries, published monthly at New York, N. Y., for April 1, 1931.
State of New York, County of New York.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared Alan Porter Lee, who, having been duly sworn according to law, deposes and says that he is the Editor of the Oil & Fat Industries and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publishers, MacNair-Dorland Company, Inc., 136 Liberty St., N. Y. C.; Editor, Alan Porter Lee, 136 Liberty St., N. Y. C.; Managing Editor, None; Business Manager, Grant A. Dorland, 136 Liberty St., N. Y. C.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

MacNair-Dorland Co., Inc., 136 Liberty St., N. Y. C., Grant A. Dorland, 136 Liberty St., N. Y. C., Ira P. MacNair. 136 Liberty St., N. Y. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

[Signed] Alan Porter Lee.

Sworn to and subscribed before me this 19th day of March, 1931.

Al. J. Ruggiero, Notary Public. Kings Co., No. 500, Reg. No. 1162; Cert. filed in N. Y. Co., No. 309, Reg. No. 1R242; Commission expires March 30th, 1931.

ABSTRACTS

David Wesson, *Abstract Editor*

Fatty acids of high molecular weight may be sulfonated to a high content of combined sulfuric acid by carrying out the sulfonation in the presence of chlorides of sulfur, boron chloride, boric acid or its anhydride, or mixed anhydrides of acetic acid or its homologs with inorganic acids such as boric, sulfuric, or chromic. Fr. Pat. No. 688,637.

In a new method for the preparation of soluble oils, castor oil was esterified by treating for twelve hours with the product of reaction of chlorosulfonic acid and pyridine. The trisulfuric ester of castor oil was isolated by neutralizing with sodium carbonate and distilling in vacuo at 40°. It was purified by solution in absolute alcohol. *Bull. soc. ind. Mul.* 96, 636-42 (1930). *Chem. Abstr.* 27, 1111 (1931).

Fat-containing solid animal material is digested under high steam pressures to melt fats and oils, and the digested material is continuously dehydrated in a vacuum to a moisture content below 20%. U. S. Pat. No. 1,789,751.

For the production of high-grade soaps from low-grade fats, it is claimed that dark low-grade fats, high in fatty acids may be esterified with methyl or ethyl alcohol and the esters distilled in a vacuum; the distilled esters are used for the manufacture of light-colored neutral soaps, the alcohol being recovered. Distilled esters obtained from original material of high iodine value may be partly hydrogenated before saponification. Alternately the low-grade fat may be hydrolyzed before esterification and the glycerol recovered. U. S. Pat. No. 1,701,703.

A pulverizable soap may be made by producing a uniform emulsion of fatty oils with an alkaline solution and a water-absorbing substance such as soda or potash 60°-70°, then allowing the emulsion to stand for a short period, say 4 to 5 hours. Brit. Pat. No. 288,584.

The darkening of fatty acids obtained by the Twitchell process is said not to be due to the addition of sulfuric acid. All reagents used in the catalytic saponification process increase the depth of color of the fatty acids with increase in heating time. The presence of air also increases the color. *J. Soc. Chem. Ind. Japan.* 33, Suppl. Bind. 500-4 (1930).

J. Davidsohn, in *Metallborse* 20,1742-3 (1930), reviews Russian contributions on hydrogenation of vegetable oils. Carbon monoxide gas is said to be a poison against the conversion of oleic into stearic acid, but not against the conversion of linolenic or linolic acid into oleic acid. *Chem. Abstr.* 27,5519 (1930).

Oxidation products of paraffin hydrocarbons may be treated with caustic alkali and the unsaponifiable portions separated out by cooling to 15° C. or lower, preferably in easy stages. The soap solution is filtered out and after neutralization with peanut oil fatty acids, may be concentrated for liquid, soft or hard soaps. *Brit. Pat.* No. 308,985.

Turbidity in soap solutions may be due to hydrolysis or to precipitated lime soaps. The latter may be prevented by the addition of 0.5% potassium chloride or 1 to 3% sugar solution on the basis of the soap solution. *Chem. Umschau Fette, Oele, Wachse u. Harze,* 37, 3233 (1930).

In experiments to determine the rate of oxidation of linseed oil at 160°, samples of raw linseed oil, linseed oil acids and synthetic esters of oleic and linolenic acids were blown with oxygen in a closed apparatus supplied with an electromagnetic circulating pump. The water and carbon dioxide evolved during oxidation were absorbed in sulfuric acid and soda lime. The hydrocarbons evolved were burned to water and carbon dioxide, which were likewise absorbed. Gelation of the pure oil occurred after 5 hours, when approximately 12.5 percent of oxygen had been absorbed. Dilution of the oxygen stream with 50 percent of nitrogen increased the time of gelation to over 9 hours and decreased the oxygen absorption by 5.7 percent. Though the free linseed oil acids gelled slowly and absorbed much oxygen, the presence of 15 percent of these acids accelerated the gelation of the raw linseed oil. *Ind. Eng. Chem.* 23, 53-7 (1931).

Lecithin

(*From Page* 143)

servatives or antihydrol which appeared to be lipoid in character and was probably lecithin or a closely related substance.[1] The ingredient, which could be partially covered by the cadmium chloride method, was easily rendered inactive by treatment with hydrochloric acid or the 20% sulfuric acid solution, thus explaining why the pretreatment with sulfuric acid is necessary in the plant prior to "splitting" a fat with the Twitchell catalyst. The protective action of lecithin upon a fat against hydrolysis was nicely shown by the following experiment. Eight grams of commercial lecithin of about 50% concentration from soy bean was incorporated in lard, which was then subjected to hydrolysis with water and catalyst in the presence of oxalic acid in the customary manner. Even after six hours of energetic treatment only 20% of fatty acids had been produced. The curves in Fig. 3 show the comparison in the rate of hydrolysis between lard with and without lecithin.

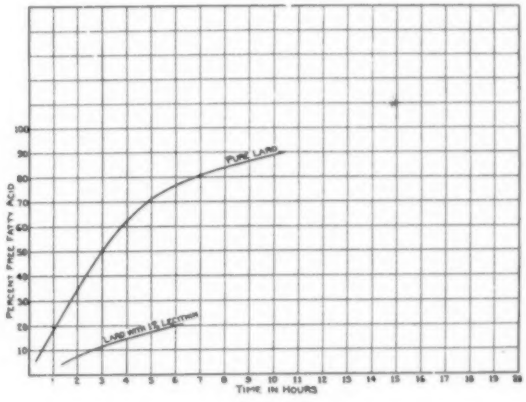


Fig. 3

Hence the resistance of certain fatty oils to hydrolysis is indirectly attributed to lecithin, or a related body, which is known to be present in these oils.

[1] The following valuable information was contributed by Dr. A. S. Richardson.

"Work by Mr. C. V. Conley in the Chemical Division of the Procter & Gamble Company some years ago indicated that 'poisoning' of Twitchell saponifier is a property of oil soluble nitrogen bases generally. Diethyl aniline affords a good illustration of this action."

Margarine Legislation

(*From Page* 145)

of the crude gum (oleoresin) from which derived: Gum spirits of turpentine and gum rosin, as defined in the Naval Stores Act, approved March 3, 1923."

SEC. 4. This Act shall take effect upon the expiration of ninety days after the date of its enactment except section 3, which shall take effect upon the approval of this Act.

NICHOLAS LONGWORTH,
Speaker of the House of Representatives.

CHARLES CURTIS,
Vice President of the United States and President of the Senate.

Approved, March 4, 1931,
HERBERT HOOVER.

Higher fatty acid peroxides and peroxy compounds, such as valeryl, caproyl, capryl, lauryl, palmityl, oleyl, stearyl and ricinolyl peroxides and peracids, suitable for bleaching, for use in pharmaceutical preparations, for synthesis, as bactericides and in dentifrices, are prepared by treating higher fatty acid chlorides with a solution of an alkali metal peroxide preferably of a concentration not over 10 percent. Br. Pat. No. 334,531.

The clouding point of a soap solution has been defined as that temperature at which a soap solution containing three per cent of fatty acids combined with alkali becomes turbid. In washing textiles, if the clouding point lies above the temperature of the washing water, soap is precipitated on the fibres and interferes with subsequent dyeing or printing. Apparatus for determining the clouding point comprises a jacketed beaker fitted with a thermometer and stirrer, and placed in a vessel filled with hot water. The jacket has a narrow vertical slit in one side and a slit three times as wide with a narrow strip down the middle on the opposite side. Soap solution heated above its clouding point is poured into the beaker and viewed through the narrow slit, illumination being provided behind the wider slit. The temperature at which cloudiness first begins to appear is taken as the clouding point. *Chem.-Ztg.* 49, 1012 (1930).

Sulfonated oils are said to possess practical advantages over soap as emulsifying agents because of the greater stability and uniformity of the former, their greater stability in acids, alkalies and hard water and their greater powers of dispersion and penetration. *Am. Silk. J.* 49, No. 64-6 (1930).

OIL & FAT INDUSTRIES

The Editor's Page

A Menace to Oil Crushing

A SERIOUS menace to crushers and refiners of vegetable and animal oils the world over has come up out of the Antarctic seas in the form of a huge overproduction of whale oil.

The quick profits gained from Antarctic whaling operations have caused the organization of whaling companies, in Norway particularly, to be carried beyond all bounds. The speculation in whaling shares in Oslo, Bergen and Stavanger nine months ago gave rise to reminiscence of the Mississippi bubble, the London rubber flotations and other similar get-rich-quick frenzies which have seized entire nations in the past. Fear that the whales would soon be exterminated was felt throughout the world of consumers of fats.

Events have seemed to rout such fears. The many whalers operating in the Antarctic field during the past season have gathered the record haul of over four million barrels of oil, and report the presence of the whales in greater abundance than ever before.

The whaling shareholders, however, need not expect a continuation of huge profits from their ventures, their aim having been defeated by the very extent of the operating success. Whale oil is appearing in the fat-consuming centers in such abundance that the surplus is failing to find ready buyers at any price.

Therein lies a distinct menace to the success of all crushers of vegetable oils and producers of tallows and greases. The large consumers have rejected the surplus whale oil. It is inconceivable that the owners of the whaling enterprises will do other than transport that surplus to convenient places for storage and persist in offering it to all and sundry buyers at prices which will make all other oil look expensive in comparison. The oil, when hydrogenated, is suitable for shortening or margarine purposes, so that it can enter into competition with practically any grade of fat.

American oil crushers are fortunate in that the Tariff affords them some measure of protection against this million barrels of whale oil which must eventually be absorbed by the world's markets. The excess is, however, going to strike a blow at the heart of oil crushing the world over. The virtually complete suspension of whaling next season is undoubtedly the only thing which will prevent it from being a death blow.

Science—Pure or "Commercial"?

THOSE who are devoting, or planning to devote their lives to the chemistry of foods and food products should pause, at this juncture, to consider well whether they are willing to persist in the combat against modern prejudices which are apparently as deepseated as those of medieval times.

There are apparently just two avenues of endeavor open to the chemist who would specialize in food work. He may become a "nutrition specialist" and under the paternal ægis of some food producer or manufacturer, or of some group, he will promptly discover that the only road to health for the human race is paved, parked and graded with the particular food of his backers, be that food milk, honey, bread, meat or psyllium seed.

If, on the other hand, scorning the leash of such guidance, he ventures along the flowered path of originality and dares to discover new and wholesome foods or new uses for known products, he immediately becomes, in the eyes of the "things-as-they-are" crowd, a charlatan, a champion of substitutes, a fraud, one who would stunt the growth of the nation's children, a mountebank. In short, no designation is severe enough for one who threatens *their* monopoly.

It is our belief that such an attitude toward progress will stifle initiative. Many a gift of value will be lost to the world because young chemists starting their careers will deliberately choose the avenue of commendation rather than that of vituperation.

We of this age look back upon the dark ages when witches were burned and scolds were ducked, and remark complacently, "How narrow-minded they were in those days". *We* wonder what will be the comment of the historians of three hundred years hence upon the "broadmindedness" of our age toward scientific achievement, pure or "commercial."

On to New Orleans

The Annual Meeting of the American Oil Chemists Society, to be held at the Hotel Roosevelt, New Orleans, Thursday and Friday, May 14th and 15th, is arousing more than usual interest this year because of the most interesting and attractive program of scientific and technical papers which has been assembled by President W. H. Irwin. The complete program is published in this issue of OIL & FAT INDUSTRIES.

The New Orleans Committee on Arrangements promises new and unusual entertainment features and a record-breaking attendance is forecast.

All members are urged to make an especial effort to attend, and all others interested in the chemistry and technology of oils and fats are invited to be present.

Golf! Golf!! Golf!!!

WEBSTER says a chemist is "one versed in the science of the composition of substances, and of their transformation, or in the application of chemical theory and method to a particular subject."

G. W. AGEE
Defending "Champ"

When the subject becomes that of the ballistic properties of guttapercha, and the transformation refers to the efficient removal of a small spherical pellet from a specified number of given locations to a uniform number of cylindrical spaces, despite all natural, artificial, imaginary and psychological forces in opposition, the many variations of research procedure resorted to in attempts to solve the problem, by chemists in general, and oil chemists in particular, are fruitful sources of instruction, not to say entertainment, for all bystanders, innocent or otherwise.

Some investigators maintain that the proper method of procedure is to slip up upon the victim in a nonchalant carefree manner and clout him quickly, without conscious effort. The other school of thought defends the method of routine, technique, practicque or what have you. These delvers into the abstruse mysteries of science pay most meticulous attention to apparatus, style, manner of approaching the problem (or the ball, or the green), posture, timing, follow-through, swing, counterswing, or what haven't you.

At great cost to this Journal, our special investigator has interviewed all the authorities, including Will Rogers and Evangeline Adams, and reports that no matter what claims these research workers may make to being golfers, they are still chemists, and oil chemists, at that.

"Try and get it away from him"

All of which is by way of introducing the fact that there is to be a great golf tournament for oil chemists at the Metairie Country Club, New Orleans, Louisiana, at 2:00 P.M. Sharp, on Thursday, May 14th, 1931. The spoils of the competition will include one year's possession of the Nuchar Challenge Cup, a Medal for the winner, many and varied pieces of golfing apparatus and gear, sundry articles of clothing (which may fit) and other honors. By special permission of the copyright owners, we are privileged to reproduce herewith photographs of the present and last previous holders of the Challenge Cup. It is rumored that these two gentlemen (having previously been acquainted with each other somewhere) have entered into a compact or conspiracy to keep said cup as a decoration of the temple in a certain city of ancient kings.

As we go to press we hear rumors of a counter-revolution. We hope the shooting will be exciting, and not too dangerous to the bystanders.

Position Wanted: Capable executive, qualified by training and experience as General Manager or Sales Manager of edible oil refinery, compound or margarine business. Experience covers general management in such lines, including all edible oil specialties, coconut butters, salad oil, mayonnaise, margarine, shortening. Address Box A12, % *Oil & Fat Industries*, 136 Liberty Street, New York, N. Y.

Oil Chemists' Program Completed

Twenty-second Annual Gathering at New Orleans to Feature Symposium on Causes of Rancidity in Fats

W. H. IRWIN, President of The American Oil Chemists' Society, announces competition of the program for the Twenty-second Annual Meeting of the society, to be held at the Roosevelt Hotel, New Orleans, Louisiana, May 14th and 15th, 1931.

W. H. Irwin

One of the most interesting features of the meeting will be a symposium on rancidity of fats and oils and the causes thereof. Papers bearing on this subject will include discussion of the compounds giving rise to rancidity color reactions, the problems of mayonnaise spoilage, the effect of various types of packing materials on rancidity in shortening and the effect of rancidity on various analytical methods.

Complete reports of the various research and methods committees of the society will be presented, in addition to several original papers on various subjects not directly connected with the subject of rancidity. Among the more interesting of these contributions is included a paper descriptive of the characteristics of Zapote seed and oil, to be presented by Dr. George S. Jamieson, Chemist in Charge of the Oil, Fat and Wax Laboratory of the Bureau of Chemistry and Soils, U. S. Department of Agriculture. Of undoubted appeal to many of the members will be a paper on plant accounting as a field for chemists, to be delivered by W. J. Reese, Chief Chemist, Colgate-Palmolive-Peet Company, Kansas City, Kansas.

The Local Committee on Arrangements, E. G. Williams, *Chairman*, have planned entertainment features of the first rank for the visiting members and for the ladies attending. The Annual Banquet, always a most enjoyable feature of the meeting, will be held this year at the Louisianne Restaurant, long noted for its Creole cuisine.

The Golf Tournament Committee have completed their list of prizes and expect numerous entries in the Cup and Medal competition. The golf tournament will be held at 2:00 P. M. on the first day of the meeting, Thursday, May 14th, on the beautiful links of the Metairie Country Club.

The complete program of the meeting is as follows:

Program of the
TWENTY-SECOND ANNUAL MEETING OF THE AMERICAN OIL CHEMISTS' SOCIETY
Roosevelt Hotel
New Orleans, La., May 14-15, 1931

President
W. H. Irwin, Chicago, Ill.

Vice-Presidents
A. S. Richardson, Cincinnati, Ohio
M. M. Durkee, Decatur, Ill.
L. B. Forbes, Little Rock, Ark.
A. Campbell, Cincinnati, Ohio

Secretary-Treasurer
J. C. P. Helm, New Orleans, La.
W. A. Peterson, Sec'y Soap Section, Brooklyn, N. Y.

Official Journal
OIL AND FAT INDUSTRIES
Alan P. Lee, *Editor*

Editorial Advisory Board
A. D. Holmes, G. S. Jamieson, H. J. Morrison, Claude E. McLean, A. W. Putland, W. D. Richardson, Maximilian Toch, H. P. Trevithick, David Wesson, Herman Aspegren.

Governing Committee
W. H. Irwin, *Chairman*
A. S. Richardson, M. M. Durkee, L. B. Forbes, A. Campbell, W. R. Stryker, A. W. Putland, R. H. Fash, H. P. Trevithick.

Referee Board
W. H. Irwin, *Chairman*
Felix Paquin, L. C. Haskell, H. Aspegren, W. R. Stryker.

Local Committee
E. G. Williams, *Chairman*

PROGRAM
Thursday, May 14, 1931
Convention called to order at 9:30 A. M.
E. G. Williams
Chairman Local Arrangements Committee

* * *

Invocation
Father Albert Beaver, S. J.

* * *

Opening of Twenty-Second Annual Meeting

* * *

Reading of Minutes of Last Annual Meeting
J. C. P. Helm

* * *

Address of President
W. H. Irwin

* * *

Report of Secretary-Treasurer
J. C. P. Helm
Report of Governing Committee
J. C. P. Helm
Report of Membership Committee
A. S. Richardson, *Chairman*
Report of Soap Section
A. Campbell, *General Chairman*
Report of Soap Committee
H. P. Trevithick, *Chairman*
Report of Glycerin Committee
J. T. R. Andrews, *Chairman*
Zapote (Mammy Apple) Seed and Oil
G. S. Jamieson
Report of Sampling Committee
C. V. Serbell, *Chairman*
Report of Cottonseed Analysis Committee
C. H. Cox, *Chairman*
Plant Accounting as a Field for Chemists
W. J. Reese
Report of Crude Mill Operations Committee
A. K. Schwartz, *Chairman*

PROGRAM
The Forming and Pressing of Cakes
J. G. Gibson
Report of the Color Committee
W. D. Hutchins, *Chairman*
Measurements with the A. P. C. Photoelectric Spectrophotometer
By Monroe Barnard and Paul McMichael
Report of the Refining Committee
C. B. Cluff, *Chairman*
Report of the Solvents Committee
R. H. Fash, *Chairman*
Some Aspects of the Seed Grading Plan Having Reference to the Oil Mill
A. K. Schwartz

At this period there will be a general discussion on Methods with the Chemists' Committee of the National Cottonseed Products' Association.
Thos. C. Law, *Chairman*

* * *

Appointment of Special Committees

* * *

ANNOUNCEMENTS
Golf Tournament—2:00 P. M.
Banquet—7:30 P. M.
"Restaurant de la Louisianne"

* * *

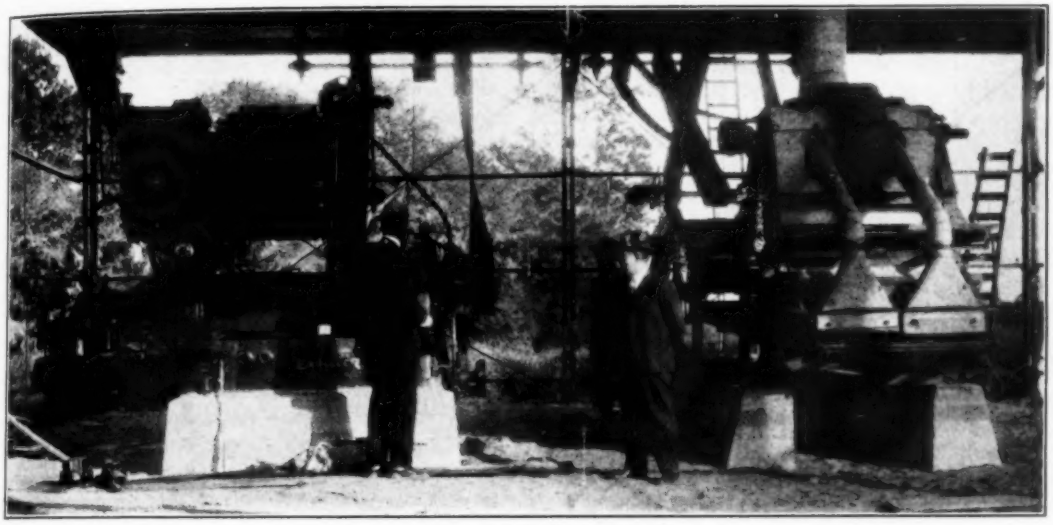
Adjournment until 9:30 A. M., Friday

PROGRAM
Friday, May 15, 1931
Report of Olive Oil Committee
M. F. Lauro, *Chairman*
Report of Smalley Foundation
A. W. Putland, *Chairman*
Halphen Test on Kapok Oil
H. P. Trevithick and W. H. Dickhart
Referee Board Report
W. H. Irwin, *Chairman*
Report of Moisture Committee
N. C. Hamner, *Chairman*
Report of Committee on Basic Research
E. R. Barrow, *Chairman*
Report of the Fat Analysis Committee
W. D. Richardson, *Chairman*
Report of Committee on Publication of Methods
W. H. Irwin
Isolation of Compounds Giving Rise to Kreis Color Reaction
L. B. Kilgore
Rancidity of Oil and the Problem of Mayonnaise Spoilage
A. S. Richardson and E. W. Eckey
The Rancidity Effect of Various Layer Boards on Shortening
W. Rabak
Report of the Kreis Test Committee
A. S. Richardson, *Chairman*
Report of Planning & Uniform Methods Committee
J. J. Vollertsen, *Chairman*
Reports of Special Convention Committees
Miscellaneous Business
Report of Nominating Committee
Election of Officers
Adjournment.

In a series of laboratory tests on methods of determining fatty acids in soaps, J. Davidsohn dried the acids at 100°, and noted appreciable losses in the acids of tallow-coconut oil soaps, thus confirming the accuracy of the Goldschmidt method in which the acids are dried in ether solution at room temperature with anhydrous sodium sulfate, the ether evaporated at 50-60° and the acids weighed. *Chem. Umschau Fette, Oele, Wachse u. Harze* 37,293-6 (1930).

Rapid Development of Tung Oil Plantations

America Soon to Be Independent of Foreign Sources for Important Paint, Varnish and Linoleum Oil Ingredient



Pioneer Tung Oil Expeller Plant

INDICATIONS are that plans, which have been maturing for the last few years, for the development of a tung oil producing industry in the United States on a scale sufficiently large to place it in the category of "big business" will be set in motion during the next few months. The plans are those which have been formulated by a number of groups of large financial and business interests which propose to establish tung tree groves in Florida and other southern states containing many thousands of these trees, the number being steadily added to each year over the course of the next few years until there will be hundreds of thousands of young trees growing, or in other words, a sufficient number of the trees to assure a supply of tung, or chinawood, oil sufficiently large to meet a major portion proportion of American industrial needs.

Fairly accurate estimates which have recently been made show that there will probably be not less than 1,000,000 seedling trees set out during the next two or three months, or a total regarded as about the requirements for approximately 10,000 acres of land in the state of Florida, with possibly 1,000 to 1,500 additional acres in Mississippi, Louisiana and Alabama. There are at present about 8,000 acres in Florida planted to commercial groves of tung trees, from a large part of which the second American-grown crop of tung oil is now being produced. This crop is infinitesimal, so to speak, as far as American industrial requirements go, and it will take years of steady increase in plantings as well as in crop returns from maturing trees to produce the hundred million pounds or more annually consumed in the United States and now obtained entirely from China.

Realizing that American industry cannot afford to allow its interests to be continually jeopardized by such an unstable source of supply as China has always presented for such an

immensely desirable raw material, the large financial and business interests, heretofore mentioned, have evolved plans which will eventually overcome these hazards while providing a large new American agricultural and milling industry which will keep at home millions of dollars heretofore expended abroad for tung oil.

Companies Organized

QUITE a number of companies have been organized in recent months for the development of groves and, while some have not been of a type to inspire any belief in their sincerity of purpose other than of selling stock or land, many have plans which will eventually produce a real American tung oil industry. One of these companies, sponsored by a substantial financial and business group is planning to spend $10,000,000 over a period of ten years in developing approximately 50,000 acres of tung tree plantations while another has plans for $5,000,000 in expenditures for the development of around 20,000 acres. These are but two of the larger ones and there are a number running close to the million dollar mark each in their projected plans.

At least one of the larger groups has organized a subsidiary company which is carrying on research work with a view to discovery of new uses for tung oil and it has been reported that this company has found a new use which it is believed will be of substantial importance and value to the motion-picture and camera film manufacturing industry. Yet another indication of the possibilities of this research work is to be found in a recent statement that government chemists have come to the conclusion that the shells or hulls of the tung nut will yield a most valuable raw material for the manufacture of insecticides. The tung tree, it may be recalled, has proven to be virtually entirely free from injury by insects or other form of plant enemy and is among the hardiest trees in this respect that has ever been found.

The oil obtained from its fruit has been used industrially in this country for about sixty years with new uses being found constantly throughout that period until today there are probably several hundred articles of manufacture or industrial use into which tung oil enters as an important ingredient. Furthermore the consumption has grown from a few thousand pounds a half century ago to better than a hundred million pounds at this time.

Industries Using Tung Oil

WHILE probably the greater proportion of the tung oil brought into the country is consumed by the paint and varnish industry, there are huge quantities required for other manufacturers, this being especially so of the electrical industry, which annually uses millions of gallons of a tung oil compound for coating cables, telephone wires, dynamos, generators, fans, and innumerable other items of equipment. The automobile industry is yet another industry requiring huge annual quantities, inasmuch as every brake band on the millions of automobiles turned out has tung oil in it as a binding composition to keep it together. More than 2,000,000 pounds of the oil each year goes into the manufacture of the little tubes used to hold cosmetics, being used to make a coating on them. Then there is linoleum and oilcloth, many million feet of which are manufactured in this country each year, and each foot of which represents a consumption of tung oil in giving those products their finish and waterproofing qualities.

In the paint and varnish industry there are several hundred items into which tung oil enters as a part of the composition.

Credit for Pioneers

CREDIT for the development of tung oil production in the United States on its present small scale must be given to the paint and varnish interests, allied with naval stores men, who have done the pioneering along with the Department of Agriculture of Florida and several scientific bodies. The work of these interests has provided the nucleus upon which the larger business and financial groups now seem about to build on a scale commensurate with the requirements of American industry. These large groups have become interested on the ground that the development of a commercial supply of tung oil such as American industries require can only be done with large financial resources and not through small stock promotions and land selling schemes.

While Florida is at present the center and leader in the infant American tung oil industry, it is anticipated that any development of an American tung industry on a scale commensurate with American industrial requirements for tung oil will make it imperative to extend operations to other states having suitable soil and climatic conditions. This is true because of the fact that there would no be enough suitable acreage available in the entire state of Florida to meet the ultimate demand, and because of this there has been considerable pioneer work done in the last few years in Mississippi, Alabama and Louisiana.

The Oil Mill Industry In Modern Germany

A Current Review of the Vegetable Oil Industry of the Republic, Including Comparison with Prewar Conditions

By Coke S. Rice*
Vice-Consul at Hamburg

Part III

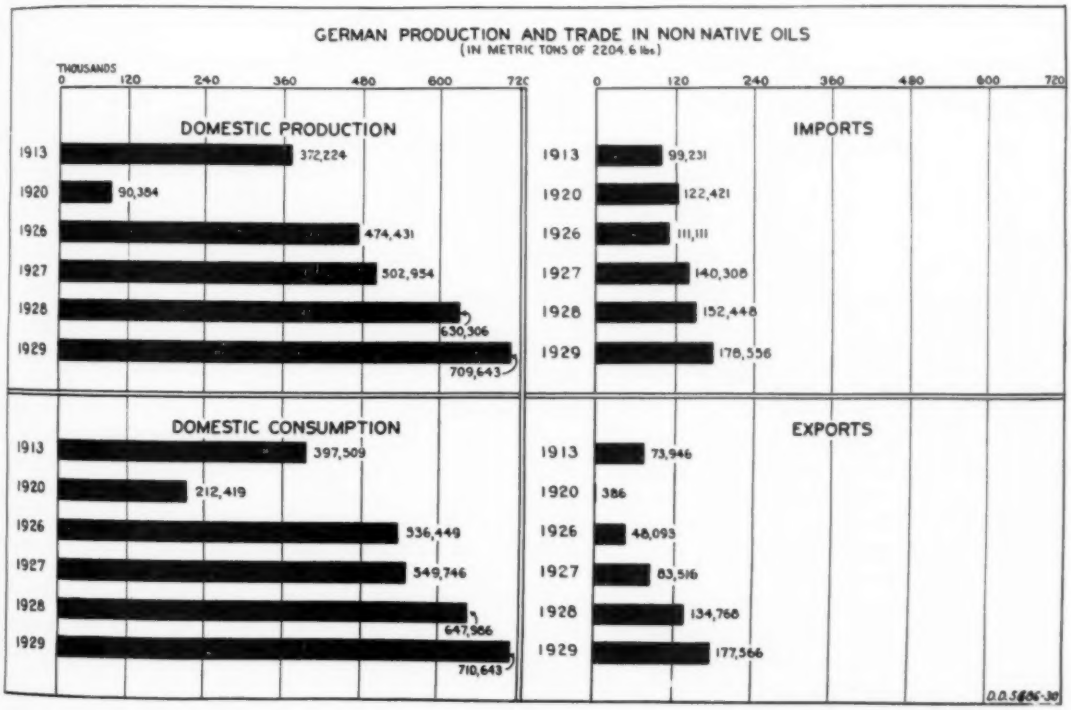
THE supply of wood or tung oil for Germany comes from China. It is used as a substitute for linseed in varnish manufacturing. The following table shows the imports of this oil for the years 1926 to 1929, inclusive. There is no duty on this oil in barrels. No detailed figures are given for exports, as the imports are for domestic consumption, a small amount being exported annually, mainly to Czechoslovakia.

WOOD OIL
(Metric tons)

Imports from:	1926	1927	1928	1929
China	4,704	6,082	6,662	6,684
Total exports:	317	296	282	260

Domestic Production

PRE-WAR production of the oil milling industry is estimated at 644,200 tons, of which 372,244 tons were from foreign raw materials. In 1928 this ratio had changed. In that year production was estimated at 844,000 tons of which 702,643 were from foreign raw materials. In keeping with the rise in the imports of raw products, peanut oil leads in increased production, with soy bean oil second. This is due to the higher oil content of the peanut. Likewise, cottonseed oil and sesame oil show the greatest decreases.



The following table lists the estimated domestic production of the German mills for 1913, 1920, and 1926 to 1929, inclusive, all figures being in metric tons.

EXOTIC OILS PRODUCED

	1913 Tons	1920 Tons	1926 Tons	1927 Tons	1928 Tons	1929 Tons
Domestic Production:						
Coconut oil	119,539	59,125	123,203	116,231	124,471	151,619
Cottonseed oil	36,586	87	5,461	5,942	1,262	1,327
Palm kernel oil	104,345	12,061	107,367	123,173	133,815	137,014
Peanut oil	38,417	3,917	179,293	168,883	239,416	259,484
Sesame oil	54,524	11,804	3,601	2,310	4,184	6,621
Soy bean oil	18,543	3,390	55,506	86,415	127,158	153,578
Total	372,224	90,384	474,431	502,954	630,306	709,643

In the following table are listed the total imports of foreign oils for 1913, 1920, and 1926 to 1929, inclusive. The increases from year to year are due almost entirely to the increases in the import of whale oil. Norway, furnishing whale oil, leads as the country of supply, with Great Britain and Newfoundland following.

IMPORTS OF OILS

	1913	1920	1926	1927	1928	1929
Coconut oil	594	50,631	1,877	1,068	6,255	10,512
Cottonseed oil	16,280	12,455	6,031	11,746	5,889	6,191
Palm kernel oil	49	11,241	1,471	983	1,847	990
Peanut oil	506	1,767	1,889	2,658	1,455	1,818
Sesame oil	700	434	436	174	74	16
Soya bean oil	3,140	22,010	20,000	11,472	1,118	1,985
Castor oil	9,527	1,047	5,454	8,287	8,292	8,954
Olive oil	2,285	2,894	833	1,106	1,324	1,179
Palm oil	15,072	3,040	14,119	17,254	20,267	20,068
Fish, seal, and whale oil	51,078	16,902	54,297	79,478	99,265	120,171
Wood oil	—	—	4,704	6,082	6,662	6,684
Total imports:	99,231	122,421	111,111	140,308	152,448	178,568
Imports from:						
British West Africa			7,456	11,998	15,614	15,327
British South Africa			980	4,389	7,968	10,550
Angola			1,138	—	—	—
Arctic Regions			—	—	—	24,308
Belgium			2,362	3,516	3,700	3,656
Great Britain			12,513	12,527	15,407	11,076
China			20,779	16,321	7,347	6,684
Congo			4,122	1,017	626	1,754
Denmark			1,668	3,940	3,499	3,562
Egypt			366	3,196	—	1,473
Netherland Indies			183	1,988	3,734	7,086
Japan			932	4,604	8,971	2,924
Mexico			—	—	—	1,420
Netherlands			8,761	11,518	11,043	6,294
Newfoundland			8,001	12,513	16,708	11,019
Norway			23,875	38,302	4,798	61,861
Russia			—	3,217	—	1,398
United States			547	1,003	309	294
Other countries			16,928	10,259	52,724	7,882

Export Trade

SINCE 1913, the exports of foreign oleaginous products have increased over 250 percent. Of the total increase of 106,725 metric tons, 105,464 metric tons were exports of soy bean, peanut, and palm kernel oils. Comparing the exports of the oils produced in Germany with the local production of the same oils, shows that exports in 1913 were equal to 18.97 percent of the production, 1920, 16/100 of 1 percent; 1926, 8.9 percent; 1927, 15.4 percent; 1928, 20.4 percent; 1929, 24.2 percent, indicating the trend of the industry to a point where it will be able to take care of the local demand and at the same time increase the exports. The Netherlands lead in purchases, followed by the United States and Great Britain. Other important purchasers are: Danzig, Czechoslovakia, Austria, and Poland.

Home Consumption

THE primary cause for the rapid increase in the oil industry is increased home consumption, particularly human consumption. Economic conditions have made it necessary to find substitutes for butter and meat. Lower prices of vegetable fats have also been responsible for their increased use in the margarine industry. In 1913 animal fats constituted 53 percent of the fats worked by the margarine industry. In 1929 vegetable fats constituted 78 percent, whale oil 16 percent and animal fats only 5 percent. In 1913 technical industries consumed two-thirds of the vegetable oils sold locally, whereas by 1929 this relation was reversed.

The following table shows the estimated home consumption.

OILS CONSUMED

	1913 Tons	1920 Tons	1926 Tons	1927 Tons	1928 Tons	1929 Tons
Production	372,224	90,384	474,431	502,954	630,306	709,643
Imports	99,231	122,421	111,111	140,308	152,448	178,566
Total	471,455	212,805	585,542	643,262	782,754	888,209
Exports	73,946	386	48,093	83,516	134,768	177,566
Net consumption	397,509	212,419	536,449	549,746	647,986	710,643

It will be seen from the above that in 1929 the domestic consumption of foreign oils had increased more than 78 percent over 1913. In considering local consumption no attention is given to the raw products consumed in their natural state or used in the confectionery trades, as these quantities are of minor importance, and in addition, there are no detailed statistics available.

Oilcake and Meal

INASMUCH as oil cakes play an important part in fixing the prices of oils, it is interesting to note the amount fed to cattle in Germany. The latest estimates place the quantity at 80 kilos (176 pounds) per head annually. Oil cakes and meals are fed to cattle primarily to fatten them and to increase productions of milk and butter, 60 percent of the butter imported coming from Denmark and the Netherlands, the largest users of cattle feeds.

The following table shows the production of all oil cakes and meal for the years 1913 and 1925 to 1929, inclusive:

PRODUCTION OF OIL CAKE AND MEAL
(Stated in 1000 metric tons of 2,204.6 lbs.)

	1913	1920	1926	1927	1928	1929
Rapeseed cake	112	35	14	18	25	15
Linseed cake	385	171	218	273	303	214
Peanut cake	56	183	251	239	337	365
Soya meal	102	274	301	469	690	833
Cottonseed cake	181	38	22	27	5	6
Sesame cake	59	11	4	2	4	7
Palm kernel cake (meal)	125	120	127	145	158	162
Copra cake and meal	70	62	71	67	72	87
Other oil cakes	27	64	36	18	17	14
Total	1,117	958	1,044	1,258	1,611	1,703

Of the total oil cakes and meal produced during these years, the production from foreign raw materials was: 1913, 593,000 metric tons (53 percent); 1925, 688,000 metric tons; 1926, 776,000 metric tons; 1927, 949,000 metric tons; 1928, 1,266,000 metric tons; and 1929 1,460,000 metric tons (85 percent). This increase in production from foreign raw materials is due to the increase in the use of soy beans and peanuts. The production from soy beans in 1929 was nearly half the total production.

In 1928, 2,428,000 tons of oil bearing vegetable products and 6,000 tons of oil cake from which not all the oil had been extracted, were worked. From this raw material, 802,900 metric tons of raw oil and fats were 1,594,000 tons of oil cake and meal were gained. The loss by treatment amounted to 36,000 tons or approximately 1.5 percent.

In 1913, imports constituted approximately 50 percent of the total quantity consumed, whereas in 1929 this figure had dropped to approximately 32 percent. In comparison with 1913, imports in 1929 show a reduction of about 33 percent. With the exception of 1927, there has been a steady increase in exports,

1929 showing a gain of approximately 62 percent over 1913. Whereas in 1913 exports were equal to 35 percent of the imports, in 1929 this figure had increased to 84 percent. Of the total exports, the Netherlands, Denmark, and Finland take the principal shares. Holland and Denmark supply Germany with 60 percent of the butter imported.

In comparison with the increases in production and exports, the increase in home consumption is small. Compared with 1913, home consumption in 1929 shows an increase of 7 percent. While the gain over 1913 is slight, that over 1926 is favorable, a result of a campaign by millers and cattle raising associations despite unfavorable grain prices. In 1913 domestic production equalled little over 67 percent of domestic consumption, whereas in 1929 this figure rose to 95 percent.

Conclusion

GRANTED normal conditions, the oleaginous product industries should continue to show satisfactory expansion with the possibility that outside influences may also contribute to this increased expansion. Most important among these possible influences is the present situation in the frozen meat industries. In April, 1930, there was enacted a law, so drastic in its regulations and requirements, as to practically prohibit the importation of frozen meats. This law was finally effective on September 30, 1930. As frozen meats command a lower price than fresh meat, such a restriction would undoubtedly cause a rise in the price of fresh meats, which might be reflected in the demand for margarine products.

Although this law has been put into effect, there is a possibility that some change may be made in the requirements, permitting the future importation of frozen meats in limited quantities. Whatever changes are made will reflect for or against the margarine industries. In addition, this restriction should cause an increased expansion in cattle raising. Germany is not a cattle raising country on a large scale. An expansion in this field would necessitate the use of lands now devoted to grain cultivation. This curtailment in the acreage under cultivation will diminish the local supply of grain, causing an increase in the demand for oil cakes and meal. As a matter of fact, this curtailmen has been advocated owing to the unfavorable grain prices.

On the other hand, investigating committees have been at work, with a view to determining the practicability of placing an import tariff on raw oleaginous products. At present all oil seeds and crude fish, seal and whale oils are admitted free of duty. A tariff placed on these imports would increase the price of margarine products, which would unquestionably cause a slowing down in the demand.

The growth of the industry as far as local consumption is concerned, has been purely economic. The gain in the export trade has been a natural result of increased production, as the margin of cost and the margin of production approached the same level. The oil mills in Germany still have capacity for heavier production, without further expansion. As far as the individual industries are concerned, the condition of the copra, soy bean, and peanut trade depends mainly on favorable or unfavorable crops. In the palm kernel industry there should continue to be an increase as it is gradually being reestablished in Germany, at the expense of England.

Taking the industry as a whole, a normal level is being reached and, without some outside influence at work, it should soon reach a point of normal production and growth.

The Archer-Daniels-Midland Company reported net profit of $457,820 for the six months ended February 28, 1931, after depreciation, Federal taxes and other charges. This was equal to 59 ments per share on 549,546 common shares after preferred dividends and compared with $806,160, or $1.22 per common share, for the corresponding period of 1930.

Hearings in the Federal Trade Commission's investigation of cottonseed prices will be resumed at Houston, Texas, April 22, following adjournment at New Orleans where hearings were opened April 15. The Houston hearings will be held in the Rice Hotel.

Production of mayonnaise and similar articles increased 18.7 percent in 1930, compared with 1929, according to information collected by the Foodstuffs Division of the Department of Commerce. Data were collected for 1930 from 114 manufacturers, but the yearly comparison was confined to seventy-three manufacturers who had reported also in 1928 and 1929. This group represented about two-thirds of the production.

The physical properties of fats, fatty oils or fatty acids may be modified by heating and dispersing in the fat, greatly modified isocolloids, which term includes fatty oils, natural resins and waxes. Brit. Pat. No. 337,734.

Margarine and Butter: The Unvarnished Facts

A Statement Presented Before the House of Representatives Committee on Agriculture Hearing on Oleomargarine Legislation

By DAVID WESSON

David Wesson

MY NAME is David Wesson, residence 111 South Mountain Avenue, Montclair, N.J. I am an honorary member of the National Cottonseed Products Association and am appearing as their representative to protest against the passage of bill H. R. 15934. My profession is that of chemist and chemical engineer, and I have been identified with the cottonseed-oil industry ever since the year 1884. I remember when the oleomargarine bill was passed in 1886. I was at that time employed by N. K. Fairbank Co. of Chicago, who were interested in a margarine factory known as the Garden City Dairy Co. A sample of the first seizure made under the law of 1886 was sent to me by the collector of internal revenue in Chicago for analysis, as the Government had no analytical facilities anywhere at that time. The sample represented a shipment from Chicago to Atlanta, Ga. The analysis showed it was a sample of rancid butter quite unfit for food. This was the kind of material which people thought represented oleomargarine, whereas oleomargarine made at that time from oleo oil, neutral lard, and refined yellow cottonseed oil was a sweet wholesome product and indorsed by food experts then as now as a wholesome food, valuable in the dietary, especially for those people who could not afford butter at much higher prices. Shortly after the oleomargarine bill became a law, it was discovered that more lard came out of Chicago than the hogs which were slaughtered could ever have carried in. Investigaation showed that cottonseed oil and also stearine were being added to pure lard and sold as refined lard.

Certain pork packers endeavored to stifle this competition by having Congress pass bills taxing refined lard in the same manner as oleomargarine was being taxed. I had the pleasure of appearing at the hearings of the Agricultural Committees of both the Senate and the House. The testimony produced at that time showed that the sanitary conditions under which hog lard was being manufactured were then far from desirable, and that the mixture of lard with pure vegetable oil and a selected animal fat was a better product than that of the packers. The refined lard people agreed for the sake of truth and fair play to call their product "lard compound" and neither of the bills ever passed. What has been the result? The manufacture of a wholesome food product, without the aid of congressional mollycoddling, has grown to be one of the leading industries of the South. When I first saw crude cottonseed oil the price of cottonseed was $6 to $8 a ton. It is now quoted around $30 a ton, which has been its average price for several years. At this price it means an additional realization to the farmer of $12 per bale for each bale of cotton grown during the last three or four years. During the war period the price of cottonseed went over $80 a ton. The crops of 1929 and 1930 were in round numbers 14,000,000 bales of cotton each producing something like 7,000,000 tons of seed apiece. This at $30 a ton meant $210,0000,000 annually to the southern farmer. This has been brought about by the continual work of the people composing the Cottonseed Products Association, and those working with them.

The chemist by improving refining methods of cottonseed oil has changed the product formerly used largely for soap and burning in miners' lamps, etc. into a valuable food material. As a salad oil it is used on millions of

tables, and in salads made by the housewife. It has formed the basis of a $50,000,000 industry established by the mayonnaise manufacturers. The rest of the crop is used largely in shortening and in the manufacture of margarine. If it were not for the crop of refined cottonseed oil, there would be only half enough shortening to go around if the country had to depend wholly on the annual output of hog lard.

A few years ago a tariff was put on imported vegetable oils such as peanut, sesame, and soybean with the idea of helping American farmers. It may have helped some of them, but it killed the country's large exporting trade in cottonseed oils. It also prevented the refiners of vegetable oils in this country refining vegetable oils imported from abroad and selling them at a good profit in Europe. Where ships used to go loaded with cottonseed oil from New Orleans carrying entire cargoes of cottonseed oil, we now find empty wharves. Large office forces in the business end of the large foreign export trade have been closed. The cooperage plants making the thousands of barrels to carry this oil are now empty. Likewise, employes have sought other work or have joined the army of the unemployed. The cottonseed oil which formed a large proportion of the margarine made in Holland and Germany is now replaced by the oriental oils which go direct to Holland and Germany instead of giving employment to our own refiners.

Cottonseed oil will not be assisted by a tax on margarine containing palm oil. Palm oil needs the cottonseed oil to produce the proper texture of butter. Of course, peanut oil or soybean oil could be used for the same purpose but cottonseed oil is readily available and in some respects a better oil. As a cotton oil man, I say the more palm oil put into margarine, the better the cotton oil interests will be pleased. The treasury's reports for the last year show that over 30,000,000 pounds of cottonseed oil were used as against a little over 1,000,000 pounds of palm oil.

I have listened with great interest to the talk which has been going on before your committee about the matter of color in butter and in margarine. There are one or two points, however, which have not been brought out. The color of natural butter varies from white in the wintertime from cows fed on grain, cottonseed hulls, straw and hay, to a beautiful golden color which you find in the June butter coming from cows fed on green pastures. It is a well known fact and Doctor McCollum has also stated in his writings that the white or nearly white butter of winter-fed cows is low in vitamins, whereas the rich yellow June butter is richest in these important constituents. It is also a well known fact that the buttery from Guernsey cows as a rule is richer in this golden color with which such vitamins are known to be associated than is the butter made from cows of scrub breeds fed on inferior food. Since I have been before this committee I have frequently heard the talk of a fraud, in connection with the use of yellow coloring used in oleomargarine. It has been stated by competent witnesses that leaving the nutrition question to one side, oleomargarine and butter from winter-fed cows in June has a high vitamin value and for that reason is a more valuable food than the butter from winter-fed cows. Why in the name of common sense and fairness should the latter product be colored to imitate the more desirable June butter any more than the equally deficient margarine? The American consumer is going to be defrauded in one case just as badly as in the other. I know from the questions I have heard the gentlemen of this committee ask that they are opposed to fraud. Why then do they not see that justice is done in a case like this by taxing all artificially colored products whether made by the margarine manufacturers or the dairy farmers? Perhaps the answer to the question is to be found in the remark of an Irishman who at the beginning of this machine age was watching the action of a steam shovel, "Yez can dig and dig and dig, but damn yez, ye can't vote!"

It is semi-officially announced that an Anglo-Dutch corporation is in negotiation with the Polish Government for the acquisition of quayside real estate at the port of Gdynia on which a vegetable oil plant will be constructed. The Anglo-Dutch group, it is further stated, will invest 15,000,000 zlotys* in the construction of this plant, which must be completed within 18 months, and have a production capacity of 60,000 tons of vegetable oils per annum. The Government has stipulated that Polish labor and materials must be employed as far as possible in this construction.

Under the general Customs classification of edible vegetable oils imports into Poland for the year 1930 are shown as 14,721 metric tons of a total value of 21,137,000 zlotys. The comparative figures for 1929 were 20,338 tons and 32,402,000 zlotys. About 70% of these imports were furnished by Germany last year.

*1.00 Zloty equal to $0.1122.

Report of Olive Oil Committee for 1930-1931

The Detection of "Sulfur" Oils in Olive Oils, Test for Halogenated Solvents and Iodine Number Determination

By M. F. LAURO, *Chairman*

THE following report submitted by the committee on olive oil of the American Oil Chemists' Society shows the benzoate test to be superior to the coin test for the detection of sulfur oils in olive oils, and recommends the Beilstein test for the detection of halogenated solvents in fatty oils in general. The report in full follows:

Individual Opinions

ANALYSTS 1, 2 and 4 concur in the sensitivity of the silver benzoate test when conducted according to the above modification. Lauro believes, however, that it is then too sensitive and there is the possibility of condemning a pressed oil. For this reason, the test as given by him was purposely restricted as to the later addition of the reagent and to the temperature of 150° C. so as to exactly parallel the results given by the coin test, so used on a thousand or so samples with check results. I would accordingly recommend the test as it stands. There is no need of going into the quantitative aspect as it involves some danger of uncertainty. Analyst 4 corroborates this by his statement that No. 1 oil contains substance giving a coloration similar to No. 2 sample under the modified procedure.

Analyst 6: "Coin test does not possess sufficient reliability to justify its use. Is reliable only when sulfur is contained in the oil in excessive quantities, much higher percentages than are necessary to detect by silver benzoate."

Analyst 7: "I think that this silver benzoate test is a very delicate and very satisfactory one. Certainly it proved to be much more efficient than the coin test in my hands.

All agree that at best, the coin test barely detects a 10% mixture of olive oil foots. See also report of the Committee of 1927-28, L. M. Roeg, *Chairman.*

Since a recovered oil, known in the trade as industrial oil, made from refined olive oil foots, contains a few hundredths of one-percent of sulfur due to the carbon bisulfide used for its extraction, a ten-percent admixture of this industrial oil in pressed olive oils would mean a very small amount of sulfur. I, therefore, feel it unwise to try to make the benzoate test conform to the detection of this minute amount or

Tabulation of Results.

Samples: 1. Pressed Olive Oil
2. Same with 10% olive oil foots added
3. Chlorine-extracted olive oil
4. Industrial olive oil (sulfur-extracted oil)

Tests: The Beilstein test for halogen
The Coin test for sulfur or its compounds
The Silver Benzoate test for sulfur or its compounds

Report:

CHEMIST	Sample nos. and results							
	#1		#2		#3	#4		
	Coin	Benz.	Coin	Benz.	Beilstein	Coin	Benz.	Iodine No.
1.	Neg.	Neg.	Neg.	Neg.°	Positive	Pos.	Pos.	80.4
2.	Neg.	Neg.	Neg.	Slight°	Positive	Pos.	Pos.	80.7
3.	Neg.	Neg.	Neg.	Slight	Positive	Pos.	Pos.	79.2
4.	Neg.	Neg.	Slight	Neg.°	Positive	Pos.	Neg.°	
5.	Neg.	Neg.	Slight	Slight	Positive	Pos.	Pos.	81.3
6.	Neg.	Neg.	Slight	Positive	Positive	Pos.	Pos.	80.8
7.	Neg.	Neg.	Neg.	Positive	Positive	Pos.	Pos.	81

° Positive results obtained by the Benzoate test when the reagent was added to the oil in the beginning and then heated. The test is then rendered very sensitive. It was this modification that the committee of 1927-8 had found as I did, that as little as 1% of extracted oil could be detected.

Laboratory Bleaching Technique for Fatty Oils*

Control of Moisture Content of Vital Importance in Obtaining Results Comparable to Plant Operation

By J. T. R. Andrews and R. G. Folzenlogen

THE fatty oil industry has long been cognizant of the fact that the bleaching of refined vegetable oils, such as cottonseed, with fuller's earth is considerably more efficient when performed on a factory scale than when carried out in the laboratory. The official bleaching test of the A.O.C.S., which is practically identical with that of the National Cottonseed Products Association (Rule 275, Sec. 2), makes allowance for this discrepancy between plant and laboratory by prescribing the use of 6.0% earth, an amount which is greater than that ordinarily used in the commercial bleaching of cottonseed and similar refined oils, but which is agreed to by oil technicians because they know that the laboratory bleached color can be duplicated in the plant with only about half of this earth usage. The official bleaching test was studied recently by Ma and Withrow[1]. In general, they found its main features justified. An excellent bibliography is appended to their paper.

THE official laboratory bleach test is made by heating 300 grams of refined oil in a refining cup to 120° C.; 6.0% of the official fuller's earth is added and the mixture is stirred mechanically at 250 r.p.m. for five minutes without allowing the temperature to drop below 105° C. The bleached oil is filtered through paper and the color of the clear oil is determined by matching a 5¼" column with Lovibond red and yellow type glasses.

In order to bring plant and laboratory conditions of time and temperature more closely together 105° C. and 15 minutes were selected for our first experiments. The official bleaching apparatus operated at 250 r.p.m. and 300 gram samples of oil were employed for most of our work. An open cup or beaker was used in all experiments except the few specifically described as made in covered vessels. We were fortunate in directing our early experiments to an investigation of the role of moisture in bleaching and the results obtained were so startling that the development of this idea constituted the remainder of our program.

Moisture Loss a Factor

IT WAS thought that in the laboratory, with only a 300 gm. sample in an open cup, drying would take place much more rapidly than in the plant where 50,000 to 80,000 lbs. of oil are agitated in a closed U-tank. Accordingly, comparative bleaches were made with and without addition of 1.0% of water (Table I) which showed that 3.0% earth + 1.0% of water is almost, but not quite, equal in bleaching power to 6.0% earth without water. Further experiments (Table II) showed that the optimum amount of water to be added is not proportional to the quantity of earth. For most efficient bleaching on a 300 gram scale,

TABLE I

Bleaching Refined Cottonseed Oil With and Without Added Water

(105°C.—15 minutes—open cup—original color 6.2 R)

% English Earth	Color, Lovibond Red No Water	1.0% Water
1.0	5.0	4.1
2.0	4.2	3.3
3.0	3.4	2.8
4.0	3.1	2.5
5.0	2.9	2.3
6.0	2.7	2.2

TABLE II

Bleaching Refined Cottonseed Oil With Varying Amounts of Added Water

(105°C.—15 minutes—open cup—original color 7.5 R)

% English Earth	1.0	2.0	4.0	6.0
% Water	Color, Lovibond Red			
0.00	4.5	3.1	2.3	2.0
0.20	4.1	2.9	2.1	2.1
0.50	3.7	2.7	2.0	2.0
0.75	3.4	2.4	2.0	1.7
1.0	3.3	2.3	2.0	1.8
1.5	3.3	2.4	2.0	1 9
2.0	3.4	2.4	2.1	1.9
3 0	4.7	3.8	2.3	2.1
4.0	5.4	3.8	3.1	2.3

*Presented at Fall Meeting, American Oil Chemists' Society, Chicago, Nov. 14, 1930.

[1] Ind. & Eng. Chem. Analytical Ed. Vol. 2, pp. 374-77 (October, 1930).

the water added should be about 1.0% of the weight of oil taken. Without pausing to exhibit data, some of our other findings may be summarized as follows:

1. There apparently exists an optimum intensity of agitation above and below which poorer bleaching results. Speed is not a critical factor between 150 and 250 r.p.m.

2. Best results are obtained by mixing the earth with the cold oil and adding the water before heating is begun.

3. Added moisture improves the bleaching efficiency of earth and carbon mixtures, e.g. English + Darco.

4. Oil may be humidified during bleaching by use of steam which is effective but difficult to control.

5. Free fatty acid percentage does not increase during bleaching by the moisture method with English earth or Carlton earth.

6. A blanket of inert gas (CO_2) is not beneficial and when circulated over the surface of the oil it apparently defeats in part the object of added moisture.

7. Filtration of the refined oil through paper removes excessive moisture and conditions it for bleaching by the moisture method.

8. On freshly refined oils, no difficulty was experienced in getting a smooth and apparently homogeneous suspension of earth in oil after 1.0% of water had been added, but on oils which had been dried and filtered through kieselguhr in a press a considerable tendency for the earth to agglomerate into small balls was noted. This condition was attributed to removal of soap from the oil by adsorption on the guhr and, as the trouble was prevented entirely by the addition of from 0.125 to 0.25% of 10% soap solution, this surmise was probably correct.

9. Dehydration, either by oven drying or by desiccation over H_2SO_4, lowers bleaching power to a marked degree in the case of English earth. By humidification, bleaching efficiency can be completely restored. The same observations, to a somewhat less extent, are true of all other earths which we have studied over a period covering the past three years. It should be noted that maximum bleaching efficiency with English, Carlton and Filtrol is reached at about 20% moisture content. (Tables III-A, B & C.)

TABLE III-A

Bleaching Refined Cottonseed Oil
With English Earth of Variable Moisture Content
(105°C. — 15 minutes—open cup — no added water — 2.68% dry earth)

Earth Treatment	% Moisture in Earth	Color, Lovibond Red Oil No. 1	Oil No. 2
Color before Bleaching		8.3	8.8
Dried at 105°C. 16 hrs.	0.0	4.9	5.2
Over conc. H_2SO_4 16 days	6.1	4.2	
Earth as received	10.8	3.7	3.8
Over 50% H_2SO_4 16 days	13.8	3.4	
Over water 16 days	19.8	3.1	3.4
Moistened with water, mixed and allowed to stand several days	25.6		5.4
	31.7		6.6
	36.3		7.9

TABLE III-B

Bleaching Refined Cottonseed Oil
With Carlton Earth of Variable Moisture Content
(105°C.—15 minutes — open cup — no added water — 2.75% dry earth)

Earth Treatment	% Moisture in Earth	Color, Lovibond Red
Color before bleaching		8.8
Dried 105°C. 16 hrs.	0.0	4.2
Earth as received	8.3	3.4
Moistened with water, mixed and allowed to stand several days	19.3	3.3
	26.2	3.6
	31.7	4.5
	38.2	6.3

TABLE III-C

Bleaching Refined Cottonseed Oil
With Filtrol of Variable Moisture Content
(105°C.—15 minutes—open cup—no added water)

Earth Treatment	% Moisture in Earth	Color, Lovibond Red	
% Dry Earth used in Bleach		1.28	2.57
Color before bleaching		8.8	8.8
Dried 150°C. 16 hrs.	0.0	4.3	2.6
Earth as received	14.4	3.9	2.4
Moistened with water, mixed and allowed to stand several days	19.4	3.8	2.5
	26.0	4.2	3.1
	31.8	4.4	3.3
	37.4	5.3	3.6

10. With proper moisture control, laboratory bleaching with English earth is equal to or better than plant bleaching in efficiency (Table IV-A).

TABLE IV-A

Plant vs. Laboratory Bleaching of Refined Cottonseed Oil with English Earth

Color Refined Oil	% English Earth	Color Plant Bleache1	Laboratory Color No Water	1.0% Water
8.5	2.4	3.9	4.7	3.6
6.2	2.1	3.4	4.2	3.1
8.6	2.3	3.8	4.4	2.3
10.0	2.3	3.6	4.4	3.6
9.0	2.3	3.5	4.3	3.4
8.3	1.9	3.2	4.4	3.3
8.6	2.9	3.1	3.5	3.0
8.0	1.9	3.4	4.2	3.3
7.9	1.8	4.0	4.1	2.4
Average Color		3.5	4.3	3.3

With due precaution to prevent loss of moisture during laboratory bleaching, the efficiency obtained is approximately the same as that of the plant but not quite as high as that obtainable in the laboratory when optimum moisture conditions prevail (Table IV-B).

All of the conclusions herein presented were drawn from experimental bleaches on plant refined cottonseed oil. A few experiments on refined tallow and coconut oil indicate that similar results may be expected on other fatty oils. It should be noted that these conclusions apply primarily to laboratory bleaching under the conditions described.

At this point, the question may be asked "Cannot plant as well as laboratory bleaching be improved by proper moisture control?" Our observations have led us to the opinion that under ordinary conditions this is unlikely. The optimum moisture for plant scale bleaching is much lower than 1.0%; probably nearer 0.1-0.3% and most plant refined oil direct from the settling tanks is of practically optimum moisture content for bleaching on a factory scale. In a few cases, perhaps, such as in the case of oils which have been dried for storage, moisture control may have a plant application, but we are not optimistic over the possibility of its general extension into plant practice.

Effect of Temperature

ON BLEACHES made below 100° C. there is apparently no benefit derived from added moisture. With increasing temperature, the

TABLE IV-B
Plant vs. Laboratory Bleaching of Refined Cottonseed Oil with English Earth

Color Refined Oil	% English Earth	Color Plant Bleached	Laboratory Color Covered		
			No Water		1.0% Water
8.2	2.3	3.5	4.1	3.4	3.3
7.7	1.8	3.3	4.6	3.8	3.7
7.9	1.8	3.8	4.7	3.8	3.5
6.4	1.5	4.0	4.4	3.7	3.3
Average Color		3.7	4.5	3.7	3.5

moisture method improves in efficiency, reaching a maximum at about 135° C., where 5 minutes has been found ample time. At either 135° C. for 5 minutes or at 105° C. for 15 minutes, the results obtained by the moisture method using 3.0% English earth are only slightly inferior to bleaches made by the A.O.C.S. official method using 6.0% earth (Table V).

TABLE V
Comparison with A.O.C. S. Official Bleach Test

Color Refined Oil	Official Bleach 6% Earth; 120°-105° C. 5 minutes	Color, Lovibond Red 3% Earth; 1% Water; 105° C. 15 minutes	3% Earth; 1% Water; 135° C. 5 minutes
10.4	4.1	4.4	4.4
16.8	5.4	5.7	5.2
8.2	2.1	2.3	2.1
6.9	2.1	2.2	2.1
6.4	2.1	2.2	2.3
33.0	10.2	11.2	10.8
8.2	3.2	3.6	3.6
Average Color	4.2	4.5	4.4

General Conclusions

IN EXAMINATION of a considerable number of bleaching earths, we have found very few laboratory bleach tests which are not improved by the addition of water and practically none which are injured unless the refined oil is already excessively wet. In order to make an intelligent comparison of the bleaching efficiency of earths, the laboratory test should simulate the essential conditions prevailing in actual plant practice and we claim that no test which ignores the important function of moisture will meet this requirement. By the official test, or any test in which the laboratory moisture loss is not kept at a minimum or replaced by added water, positively erroneous conclusions can be drawn regarding the relative bleaching efficiencies of two earths under factory conditions and this is especially true in case one of these earths is more sensitive to moisture control than the other.

In conclusion, it is suggested that the official bleaching method of the A.O.C.S. be modified in the way we have demonstrated as effective in putting laboratory and plant bleaches on a more comparable basis. The modified method, making use of moisture control, will enable laboratory tests on both earths and oils to be translated directly into an accurate forecast of plant scale bleaches.

Report of the Committee to Rewrite the Methods

THE CHANGES made last year in the methods, and new methods covering cottonseed made necessary the reprinting of eighteen pages of the methods. This work was done by the Lefax Company at a total cost to the Society of $82.50 for two thousand sets.

Our methods, as now being sent out, are revised to August 1, 1930.

The only recommendation this committee has to offer is that the methods covering Soap also be printed in the Official Methods.

W. H. IRWIN, *Chairman.*

Chicago, April 13, 1931.

Laboratory Construction Company of Kansas City, Missouri, reports the sale of nitrogen apparatus to Wilson and Company of Oklahoma City, and Cudahy Packing Company of Kansas City, Kansas. Also, the complete installation of Laboratory Equipment Tables and Kjeldahl Nitrogen Apparatus for the three laboratories of the Food and Dairies Division, State of Illinois at Springfield, Illinois.

The Research Association of British Paint, Colour and Varnish Manufacturers have recently issued a Review, giving abstracts of current literature relating to the paint, color and varnish industries.

Carbohydrates Affect Mill Values of Cottonseed

The Relation of Percentages of Oil, Ammonia and Meats in Whole Cottonseed to the Carbohydrate Content of Meats

By G. S. MELOY

THE oil and the protein in cottonseed are found in the kernels or meats. In the natural state the hulls or seed coats, contain no oil, and less than one-half of one per cent of ammonia, indicating less than 0.4 per cent of nitrogen, or 2.5 per cent of protein. The crushers of cottonseed therefore depend upon the meats for the production of oil and for the protein content of the cake.

The oil content of pure cottonseed meats varies from below 28 per cent to above 40 per cent; and the protein content varies from below 30 per cent to above 52 per cent. In combination the oil and protein together form from below 70 per cent to above 80 per cent of the meats. The residue, composed of carbohydrates, moisture and other minor materials, therefore forms from less than 20 per cent to more than 30 per cent of the meats. The differences in the content of these materials, in the meats of different lots of cottonseed, is therefore a factor of value in the seed.

The meats content of different lots of cottonseed varies from below 40 per cent to above 56 per cent of the whole seed, due to differences in the thickness and density of the hulls, but chiefly to differences in the vegetation development and density of the meats themselves.

Variations in the meats content of cottonseed present problems of separating meats from the hulls. The lower the percentage of meats the greater the difficulty of separation, both because of the lower specific gravity of the meats and also because of the larger portion of hulls, to be separated from the meats. Differences in the meats content of various lots of cottonseed is therefore a factor of value in the seed.

In the accompanying tables percentages of oil and ammonia in whole cottonseed are grouped in columns under various percentages of meats. In the left hand column are given the percentages of oil and protein in the meats, corresponding with and resulting from the combinations of the percentages of oil, ammonia and meats in the whole seed. In Table I are grouped analyses of whole seed in which the combined oil and protein in the meats equal 70 per cent of the meats; in Table 2 the combined oil and protein equal 74 per cent of the meats; in Table 3 the combined oil and protein equal 76 per cent of the meats, and in Table 4 the combined oil and protein equal 80 per cent of the meats.

Similar tables may be prepared showing practically every possible combination of oil, ammonia and meats percentages found in whole seed and the corresponding oil and protein content of pure meats. These tables, however, are sufficient for this discussion. Tables 1 and 4 represent practically the extremes of variations, while Tables 2 and 3 represent the modal variations of normal cottonseed.

The average oil content of cottonseed, 19 per cent, and average ammonia content, 3.50 per cent, is found in the column 50 per cent meats, Table 2. In the left hand column it is seen that these percentages of oil, ammonia and meats in whole seed indicate that the percentage of oil in the meats is 38 and the percentage of protein 36, making a combination of 74 per cent of the meats.

These tables show that when the percentage of oil in whole cottonseed remains constant, increase in the ammonia content is the result of increases in the meats content and is coincident with increase in the content of materials in the meats other than protein and fat. Also that increases in both oil and ammonia in whole seed result from increases in the meats content and may or may not be coincident with increase of material in the meats other than protein and fat, depending upon the ratio of the increase in ammonia.

The tables also furnish a basis for visualizing the composition of cottonseed in connection with various growing conditions. For instance, typical combinations of oil and ammonia in seed produced in the drought area of Arkansas,

Mississippi and Tennessee, during the past season, are found in the columns of meat content between 40 and 45 per cent, Tables 3 and 4, indicating a retarded or arrested vegetative development of the kernels or meats.

Typical combinations of oil and ammonia, in seed produced in northwestern Texas and western Oklahoma, are to be found in the columns of percentages of meats above 50 and generally also in Table 1 in which the combined oil and protein is only 70 per cent of the meats and are therefore concurrent with a high content of non-protein or fat materials in the meats, chiefly carbohydrates.

These significant differences in the carbohydrate content of cottonseed meats doubtless have marked influence on the color and refining loss of oil and possibly also on the color of the cake. High carbohydrate content may indicate lower cooking temperatures.

Variations in the content of carbohydrates in cottonseed kernels has apparently received very little consideration in past studies of the composition of cottonseed.

TABLES SHOWING THE RELATION BETWEEN THE PERCENTAGES OF OIL, AMMONIA AND MEATS IN WHOLE SEED AND COMBINED OIL AND PROTEIN IN MEATS

Table 1

Oil & Protein totaling 70% of meats — Percentages of meats in whole seed

Oil Per cent	Protein Per cent	42 Oil Per cent	42 NH_3 Per cent	44 Oil Per cent	44 NH_3 Per cent	46 Oil Per cent	46 NH_3 Per cent	48 Oil Per cent	48 NH_3 Per cent	50 Oil Per cent	50 NH_3 Per cent	52 Oil Per cent	52 NH_3 Per cent	54 Oil Per cent	54 NH_3 Per cent	56 Oil Per cent	56 NH_3 Per cent
28	42	11.76	3.43	12.32	3.60	12.88	3.76	13.44	3.92	14.00	4.09	14.56	4.25	15.12	4.41	15.68	4.57
29	41	12.18	3.35	12.76	3.51	13.34	3.67	13.92	3.83	14.50	3.99	15.08	4.15	15.66	4.30	16.24	4.46
30	40	12.60	3.27	13.20	3.42	13.80	3.58	14.40	3.73	15.00	3.89	15.60	4.05	16.20	4.20	16.80	4.36
31	39	13.02	3.19	13.64	3.33	14.26	3.49	14.88	3.65	15.50	3.79	16.12	3.94	16.74	4.10	17.36	4.24
32	38	13.44	3.10	14.08	3.25	14.72	3.40	15.36	3.55	16.00	3.70	16.64	3.84	17.28	3.99	17.92	4.14
33	37	13.86	3.02	14.52	3.16	15.18	3.31	15.84	3.45	16.50	3.60	17.16	3.75	17.82	3.89	18.48	4.03
34	36	14.28	2.94	14.96	3.08	15.64	3.22	16.32	3.36	17.00	3.50	17.68	3.64	18.36	3.78	19.04	3.92
35	35	14.70	2.85	15.40	2.99	16.10	3.13	16.80	3.27	17.50	3.40	18.20	3.54	18.90	3.67	19.60	3.82
36	34	15.12	2.77	15.84	2.91	16.56	3.04	17.28	3.17	18.00	3.31	18.72	3.44	19.44	3.57	20.16	3.71
37	33	15.54	2.70	16.28	2.82	17.02	3.95	17.76	3.08	18.50	3.21	19.24	3.33	19.98	3.47	20.72	3.60
38	32	15.96	2.61	16.72	2.74	17.48	2.86	18.24	2.99	19.00	3.11	19.76	3.23	20.52	3.36	21.28	3.49
39	31	16.38	2.53	17.16	2.65	17.94	2.77	18.72	2.89	19.50	3.02	20.28	3.14	21.06	3.26	21.84	3.38
40	30	16.80	2.45	17.60	2.57	18.40	2.69	19.20	2.80	20.00	2.92	20.80	3.04	21.60	3.15	22.40	3.27

Table 2

Oil & Protein totaling 74% of meats — Percentages of meats in whole seed

Oil Per cent	Protein Per cent	42 Oil Per cent	42 NH_3 Per cent	44 Oil Per cent	44 NH_3 Per cent	46 Oil Per cent	46 NH_3 Per cent	48 Oil Per cent	48 NH_3 Per cent	50 Oil Per cent	50 NH_3 Per cent	52 Oil Per cent	52 NH_3 Per cent	54 Oil Per cent	54 NH_3 Per cent	56 Oil Per cent	56 NH_3 Per cent
28	46	11.76	3.76	12.32	3.94	12.88	4.11	13.44	4.29	14.00	4.47	14.56	4.66	15.12	4.83	15.68	5.01
29	45	12.18	3.67	12.76	3.85	13.34	4.02	13.92	4.20	14.50	4.38	15.08	4.55	15.66	4.73	16.24	4.90
30	44	12.60	3.60	13.20	3.77	13.80	3.94	14.40	4.11	15.00	4.28	15.60	4.45	16.20	4.62	16.80	4.79
31	43	13.02	3.51	13.64	3.68	14.26	3.84	14.88	4.01	15.50	4.18	16.12	4.35	16.74	4.51	17.36	4.68
32	42	13.44	3.43	14.08	3.60	14.72	3.76	15.36	3.92	16.00	4.09	16.64	4.25	17.28	4.41	17.92	4.57
33	41	13.86	3.35	14.52	3.51	15.18	3.67	15.84	3.83	16.50	3.99	17.16	4.15	17.82	4.30	18.48	4.46
34	40	14.28	3.27	14.96	3.42	15.64	3.58	16.32	3.73	17.00	3.89	17.68	4.05	18.36	4.20	19.04	4.36
35	39	14.70	3.19	15.40	3.33	16.10	3.49	16.80	3.64	17.50	3.79	18.20	3.94	18.90	4.10	19.60	4.24
36	38	15.12	3.10	15.84	3.24	16.56	3.40	17.28	3.55	18.00	3.70	18.72	3.84	19.44	3.99	20.15	4.14
37	37	15.54	3.03	16.28	3.16	17.02	3.31	17.76	3.45	18.50	3.60	19.24	3.75	19.98	3.89	20.72	4.03
38	36	15.96	2.94	16.72	3.08	17.48	3.22	18.24	3.36	19.00	3.50	19.76	3.65	20.78	3.65	21.28	3.92
39	35	16.38	2.86	17.16	2.99	17.94	3.14	18.72	3.27	19.50	3.40	20.28	3.54	21.06	3.67	21.84	3.82
40	34	16.80	2.77	17.60	2.91	18.40	3.04	19.20	3.17	20.00	3.17	20.80	3.44	21.60	3.57	22.40	3.71

Table 3

Oil & Protein totaling 76% of meats — Percentages of meats in whole seed

Oil Per cent	Protein Per cent	42 Oil Per cent	42 NH_3 Per cent	44 Oil Per cent	44 NH_3 Per cent	46 Oil Per cent	46 NH_3 Per cent	48 Oil Per cent	48 NH_3 Per cent	50 Oil Per cent	50 NH_3 Per cent	52 Oil Per cent	52 NH_3 Per cent	54 Oil Per cent	54 NH_3 Per cent	56 Oil Per cent	56 NH_3 Per cent
28	48	11.76	3.92	12.32	4.11	12.88	4.29	13.44	4.48	14.00	4.67	14.56	4.85	15.12	5.04	15.68	5.23
29	47	12.18	3.84	12.76	4.02	13.34	4.21	13.92	4.39	14.50	4.57	15.08	4.75	15.66	4.94	16.24	5.12
30	46	12.60	3.76	13.20	3.94	13.80	4.11	14.40	4.28	15.00	4.47	15.60	4.66	16.20	4.83	16.80	5.01
31	45	13.02	3.67	13.64	3.85	14.26	4.02	14.88	4.20	15.50	4.38	16.12	4.55	16.74	4.73	17.36	4.90
32	44	13.44	3.60	14.08	3.77	14.72	3.94	15.36	4.11	16.00	4.28	16.64	4.45	17.28	4.62	17.92	4.79
33	43	13.86	3.51	14.52	3.68	15.18	3.84	15.84	4.01	16.50	4.18	17.16	4.35	17.82	4.51	18.48	4.68
34	42	14.28	3.43	14.96	3.60	15.64	3.76	16.32	3.92	17.00	4.09	17.68	4.25	18.36	4.41	19.04	4.57
35	41	14.70	3.35	15.40	3.51	16.10	3.67	16.80	3.83	17.50	3.99	18.20	4.15	18.90	4.30	19.60	4.46
36	40	15.12	3.27	15.84	3.42	16.56	3.58	17.28	3.73	18.00	3.89	18.72	4.05	19.44	4.20	20.16	4.35
37	39	15.54	3.19	16.28	3.33	17.02	3.49	17.76	3.64	18.50	3.79	19.24	3.94	19.98	4.10	20.72	4.24
38	38	15.96	3.10	16.72	3.24	17.48	3.40	18.24	3.55	19.00	3.70	19.76	3.84	20.52	3.99	21.28	4.14
39	37	16.38	3.03	17.16	3.16	17.94	3.31	18.72	3.45	19.50	3.60	20.28	3.75	21.06	3.89	21.84	4.03
40	36	16.80	2.94	17.60	3.08	18.40	3.22	19.20	3.36	20.00	3.50	20.80	3.65	21.60	3.78	22.40	3.92

Table 4

Oil & Protein totaling 80% of meats — Percentages of meats in whole seed

Oil Per cent	Protein Per cent	42 Oil Per cent	42 NH_3 Per cent	44 Oil Per cent	44 NH_3 Per cent	46 Oil Per cent	46 NH_3 Per cent	48 Oil Per cent	48 NH_3 Per cent	50 Oil Per cent	50 NH_3 Per cent	52 Oil Per cent	52 NH_3 Per cent	54 Oil Per cent	54 NH_3 Per cent	56 Oil Per cent	56 NH_3 Per cent
28	52	11.76	4.25	12.32	4.45	12.88	4.66	13.44	4.85	14.00	5.06	14.56	5.26	15.12	5.46	15.68	5.67
29	51	12.18	4.16	12.76	4.37	13.34	4.56	13.92	4.76	14.50	4.96	15.08	5.16	15.66	5.35	16.24	5.56
30	50	12.60	4.09	13.20	4.28	13.80	4.47	14.40	4.67	15.00	4.86	15.60	5.06	16.20	5.25	16.80	5.45
31	49	13.02	4.00	13.64	4.20	14.26	4.38	14.88	4.57	15.50	4.77	16.12	4.96	16.74	5.15	17.36	5.34
32	48	13.44	3.92	14.08	4.11	14.72	4.29	15.36	4.48	16.00	4.67	16.64	4.85	17.28	5.04	17.92	5.23
33	47	13.86	3.84	14.52	4.02	15.18	4.21	15.84	4.39	16.50	4.57	17.16	4.75	17.82	4.94	18.48	5.12
34	46	14.28	3.76	14.96	3.94	15.64	4.11	16.32	4.28	17.00	4.47	17.68	4.66	18.36	4.83	19.04	5.01
35	45	14.70	3.67	15.40	3.85	16.10	4.02	16.80	4.20	17.50	4.38	18.20	4.55	18.90	4.73	19.60	4.90
36	44	15.12	3.60	15.84	3.77	16.56	3.94	17.28	4.11	18.00	4.28	18.72	4.45	19.44	4.62	20.16	4.79
37	43	15.54	3.51	16.28	3.68	17.02	3.84	17.76	4.01	18.50	4.18	19.24	4.35	19.98	4.51	20.72	4.68
38	42	15.96	3.43	16.72	3.60	17.48	3.76	18.24	3.92	19.00	4.09	19.76	4.25	20.52	4.41	21.28	4.57
39	41	16.38	3.35	17.16	3.51	17.94	3.67	18.72	3.83	19.50	3.99	20.28	4.15	21.06	4.30	21.84	4.46
40	40	16.80	3.27	17.60	3.42	18.40	3.58	19.20	3.73	20.00	3.89	20.80	4.05	21.60	4.20	22.40	4.36

Smalley Foundation Analytical Results

Report on Cooperative Cottonseed Meal Analyses Conducted by American Oil Chemists' Society, 1930-31

By A. W. PUTLAND, *Chairman*

THE tables attached to this report summarize the results of the cooperative analytical program of the Smalley Foundation for the past year. The program was concluded, as usual, with thirty samples. There were 99 collaborators participating, as compared to 96 for the season 1929-1930, and 102 for the season 1928-1929.

In Table No. 1 we show the standing of the 45 collaborators who reported oil determinations on all samples. In the two preceding years 45 and 46, respectively, reported oil determinations on all the samples.

Table No. 2 shows the standing of the 71 collaborators who reported ammonia results on all samples. This number compares with 75 and 74, respectively, for the two preceding seasons.

Table No. 3 gives the average for both oil and ammonia for the 45 collaborators who reported on both oil and ammonia on all samples. In the two preceding seasons 45 and 46 collaborators reported oil and ammonia on all samples.

The winning collaborators are as follows:—

The Battle Cup for the highest efficiency in the determination of both oil and ammonia on all samples is awarded to Analyst No. 19, Dr. W. F. Hand, State Chemist, Mississippi A. and M. College, whose average is 99.889 per cent. The average efficiency is slightly less than that of last year obtained by the Southwestern Laboratories with an average efficiency of 99.95½ per cent, but somewhat higher than that obtained by the winner the year previous. The certificate for second place goes to Analyst No. 49, The Southwestern Laboratories of Dallas, Texas, with an efficiency of 99.866. It is interesting to note that last year the Southwestern Laboratories was awarded the cup for an efficiency of 99.956½ per cent, while this year the same laboratory was awarded second prize with an efficiency of 99.866 per cent. It is also interesting to note that Dr. W. F. Hand, who was awarded second place last year with an efficiency of 99.926 per cent, has been awarded first place this year with an efficiency of 99.889 per cent. The efficiency of the work this year appears to be less than that of last year, a possible reason of which will be offered later. The winner of the cup this year, Dr. W. F. Hand, also won the cup in 1926-27.

The certificate for the highest efficiency in determination of the oil only is awarded to Dr. W. F. Hand, State Chemist, Mississippi A. & M. College, whose average is 99.866 per cent. The certificate for second place goes to Mr. D. B. McIsaac, International Vegetable Oil Company, Savannah, Ga., analyst No. 4, with an efficiency of 99.804 per cent. The percentage of the winner last year was 99.938 and for second place 99.918.

The certificate for the highest efficiency in the determination of ammonia is awarded to Analyst No. 14, Mr. Geo. K. Redding, The Larrowe Milling Company, Rossford, Ohio, with an average of 99.980 per cent and the certificate for second place goes to No. 49, The Southwestern Laboratories, Dallas, Texas. The foregoing comparisons show that the percentage efficiency for both oil and ammonia, as well as for the combined oil and ammonia work, is slightly less than for last year.

There have been comparatively few complaints from the collaborators regarding the samples this year. This in spite of the fact that some abnormal meal samples were sent out. These abnormal samples possibly explain the slightly less efficiency obtained by the collaborators this year than that obtained last year. The few complaints were registered against including the results of the sample which contained an unusually high oil content. The Committee felt that our official method should provide for high or low oil content samples. If it does not, then it is not a method. We, therefore, ruled that this and other samples

would be included in the final results. The Smalley Foundation Cooperative analytical program is not a contest but a means of checking our official methods in the hands of numerous operators as well as checking our individual work.

In concluding this report your Committee feels that the Society owes Mr. Thos. C. Law a tremendous debt for his care and attention in preparing and mailing the samples.

Personnel of Committee:—N. C. Hamner, L. C. Haskell, H. C. Moore, L. B. Forbes, E. A. Butt, G. K. Witmer, A. W. Putland, Chairman.

TABLE NO. I

Analyst No.	Points off	% Efficiency
19	28	99.866
4	41	99.804
93	45	99.784
49	50	99.761
31	52	99.751
80	53	99.746
86	54	99.741
58	62	99.703
7	63	99.697
37	69	99.668
84	77	99.631
43	80	99.617
9	81	99.611
40	83	99.602
13	84	99.596
26	96	99.539
70	97	99.534
15	101	99.516
6	103	99.506
53	108	99.472
69	113	99.458
92	113	99.458
2	119	99.429
79	124	99.409
35	127	99.39
77	132	99.365
88	132	99.365
3	136	99.347
71	139	99.332
60	141	99.321
56	149	99.284
58	149	99.284
81	150	99.279
10	155	99.256
75	159	99.221
5	162	99.221
74	186	99.106
59	193	99.072
66	196	99.058
20	202	99.029
45	214	98.971
62	311	98.51
83	340	98.36
72	672	96.77

TABLE NO. II

Analyst No.	Points off	% Efficiency
14	5	99.98
49	7	99.972
34	10	99.959
55	10	99.959
5	14	99.9424
89	15	99.938
53	16	99.9325
93	18	99.925
86	18	99.925
84	20	99.9168
61	20	99.9168
19	21	99.913
71	22	99.909
80	22	99.909
4	30	99.874
59	30	99.874
10	31	99.871
58	33	99.863
60	33	99.863
8	33	99.863
68	36	99.850
32	36	99.850
36	37	99.846

TABLE NO. II (Cont'd.)

Analyst No.	Points off	% Efficiency
33	38	99.842
7	39	99.837
2	40	99.833
43	41	99.829
24	42	99.825
26	43	99.821
39	43	99.821
9	44	99.817
74	45	99.813
66	47	99.805
31	47	99.805
70	48	99.8
38	49	99.796
40	51	99.788
81	53	99.780
91	54	99.775
35	56	99.768
54	57	99.766
76	58	99.756
15	61	99.744
3	63	99.738
75	67	99.721
18	67	99.721
27	67	99.721
69	68	99.719
6	68	99.719
55	72	99.700
92	74	99.692
65	78	99.674
37	81	99.796
83	84	99.65
72	86	99.641
30	89	99.630
22	93	99.612
13	94	99.608
16	106	99.558
88	106	99.558
73	116	99.517
77	125	99.482
62	128	99.467
25	129	99.462
21	130	99.46
45	131	99.455
79	151	99.37
20	153	99.362
17	163	99.333
1	166	99.309
64	348	98.548

TABLE NO. III

Analyst No.	% Efficiency
19	99.889
49	99.866
93	99.854
4	99.839
86	99.833
80	99.827
31	99.778
68	99.776
84	99.775
7	99.767
37	99.732
43	99.723
9	99.714
53	99.702
40	99.695
25	99.680
70	99.677
2	99.631
15	99.630
71	99.620
62	99.612
13	99.602
60	99.592
69	99.588
5	99.581
35	99.579
92	99.575
58	99.573
10	99.563
3	99.542
81	99.529
56	99.492
59	99.473
75	99.471
88	99.461
74	99.459
66	99.431
77	99.422
79	99.387
20	99.145
83	99.005
62	98.988
45	98.758
72	98.205

Notes of the Industry

Large Whaler Makes Port

On Saturday, April 18th, the Sir James Clarke Ross docked at Pier 20, Staten Island, New York, after a most successful voyage to the Antarctic seas. The ship is the largest cargo vessel afloat and has the additional distinction of being the largest and most modern factory ship in operation.

The modern whale handling and oil rendering equipment installed in the Ross has reduced the time of processing a whale to half of what was formerly required for a mammal of equal size. The quality of the oil obtained is very much improved, also. The processing is very simple in procedure, consisting essentially of live steam pressure rendering (60 lbs. pressure) of the blubber, meat and bone, following sedimentation of the oil for the removal of moisture. The oil is then pumped to the vessel's own storage tanks.

The Sir James Clarke Ross has deck room for handling six whales simultaneously, with three steam winches for hoisting the whales from the water through a large stern entrance chute onto the deck. There are thirty bone digesters and eight large rendering cookers for handling blubber and meat, together with a sufficient number of settling tanks to keep the rendering tanks free for continuous operation. Belt conveyors are used throughout the ship for the transport of solid materials. The bone oil is kept separate from the blubber and meat oil in the storage tanks.

The cargo landed by the Ross on this trip totaled 18,600 tons of oil. The shop could have brought a larger amount but the consignee's storage facilities were filled to capacity by this amount.

In the whaling operations in the Antarctic the whalers' crew are paid on a profit-sharing and bonus basis. The highest individual returns are amassed by the harpoon gunners, upon whose accuracy of aim the success or failure of a whaling voyage is so dependent. One of the Ross's harpoon gunners earned a total of $35,000 on the last voyage.

The members of the Mayonnaise Manufacturers Association have voted almost unanimously in favor of the Association's simplification program which contemplates the reduction of the number of sizes (not styles) of standard mayonnaise containers.

Mayonnaise Research Progresses

At a meeting of the Research Committee of the Mayonnaise Manufacturers Association, held in New York on April 9th, many problems of interest to manufacturers of mayonnaise were discussed. The Chairman of the committee, D. M. Gray read an interesting report relative to experiments on resistance to corrosion by several well-known anti-corrosive metals and alloys. The use of sugars other than sucrose in mayonnaise was discussed. L. B. Kilgore, Research Fellow of the Association, described the "Plumit," a newly developed instrument for the determination of relative density of mayonnaise mixtures. He further discussed the research plan of the Fellowship, enumerating the divisions of the contemplated work as follows:

1. Evaluation of emulsifying materials. 2. Effect of acidity on the development of rancidity in oils. 3. Color tests on fats and oils for the determination of incipient rancidity and constituents of oils producing such color reactions. 4. Methods of analysis. Determination of cholesterol volumetrically and by the zanthate method. 5. Practical tests of the value of malt sugar and other materials advocated for the improvement of mayonnaise. 6. Research on new methods of analysis. 7. Preparation of a rating or scoring card for the evaluation of commercial mayonnaise. 8. Bibliography.

According to the Georgia Agricultural Experiment Station, the varieties of soy beans adapted to the southeastern states are distinctly different from those cultivated in the north. The three varieties said to be most suitable for growth in Georgia are the Otootan, Laredo and Biloxi. The Experiment Station will furnish specifications of these varieties to those interested.

The dates and place for the Fifth Annual Convention of the Mayonnaise Manufacturers Association have been set. The meeting will be held at the Hotel Stevens, Chicago on October 26-27-28. Plans are already under way for the program. Frank Honicker is Executive Manager of the Association with offices at 1500 Walnut St., Philadelphia.

Referee Board Report

DURING the year 1930-31 the Referee Board granted certificates to only two new referees—William Black, Augusta Ga., and Clinton Morris, of the Morris-Flinn Laboratories, Macon, Ga. The following referees were re-certified for 1930-31:

Limited Referee Certificates. (All Products of the National Cottonseed Products Association). E. G. Williams, New Orleans, La.; G. K. Witmer, Battle Laboratories, Montgomery, Ala.; N. C. Hamner, Southwestern Laboratories, Dallas, Tex.; R. H. Fash, Fort Worth Laboratories, Fort Worth, Tex.; P. D. Cretien, Texas Testing Laboratories, Dallas, Tex.; F. B. Porter, Fort Worth Laboratories, Fort Worth, Tex.; T. C. Law, Law & Company, Inc., Atlanta, Ga.; P. McG. Shuey, Shuey & Co., Savannah, Ga.; F. R. Robertson, Houston Laboratories, Houston, Tex.; L. B. Forbes, L. B. Forbes Laboratories, Little Rock, Ark.; E. H. Tenet, L. B. Forbes Laboratories, Little Rock, Ark.; H. M. Shilstone, New Orleans, La.; J. C. P. Helm, New Orleans, La.; J. R. Mays, Barrow-Agee Laboratories, Shreveport, La.; E. R. Barrow, Barrow-Agee Laboratories, Memphis, Tenn.; G. W. Agee, Barrow-Agee Laboratories, Memphis, Tenn.; B. L. Caldwell, Barrow-Agee Laboratories, Jackson, Miss.; A. H. Preston, Southwestern Laboratories, San Antonio, Tex.; R. G. Huffman, G. W. Gooch Laboratories, Los Angeles, Cal.; S. Lomanitz, General Laboratories, Oklahoma City, Okla.; H. M. Bulbrook, Industrial Laboratories, Fort Worth, Tex.; F. C. Schilling, Industrial Laboratories, Fort Worth, Tex.; C. W. Rice, C. W. Rice & Co., Columbia, S. C.; N. E. Katz, Meridian, Miss.; D. C. Picard, Picard Laboratories, Birmingham, Ala.; W. J. Bramblett, San Antonio Laboratories, San Antonio, Tex.; F. Paquin, Galveston Laboratories, Galveston, Tex.; Curtis & Tompkins, Ltd., San Francisco, Cal. Limited to Cottonseed Cake, Meal & Feed Products. R. M. Chapman, Indiana Laboratories, Hammond, Ind.; S. W. Wiley, Wiley & Co., Baltimore, Md. Limited to Fish & Vegetable Oil, Cake & Meal. Laucks Laboratory, Seattle, Washington. All Products covered by the Methods of the American Oil Chemists' Society. H. P. Trevithick, Bureau of Chemistry, New York, N. Y.

So far this season the Referee Board has sent out two samples of crude oil and one sample of yellow oil as check samples to the several Referees. On the first sample of crude oil twenty-four out of twenty-eight laboratories check within +- or —.5% of the refining loss and twenty-one within .5 on color. Thirteen check within .2% on refining loss and sixteen within .2 on color.

On the second sample of crude oil sent out twenty-three out of twenty-eight check within .5% on refining loss and seventeen within .5 on color. Seventeen check within .2% on refining loss but only six come within .2 of the average on color.

On the sample of refined oil sent out for color reading, out of a total of thirty-one figures, twenty-three were within .5 red and fifteen were within .2 red.

These figures would appear to indicate that refining loss results, on the whole, are in very good agreement, but that there is a wide range in color reading. The Committee feels that this check work is important and should be continued more extensively then has been done in the past.

W. H. IRWIN, *Chairman.*
W. R. STRYKER
L. C. HASKELL
H. ASPEGREN
F. PAQUIN

Chicago, April 13, 1931.

Attempts to establish a tung oil industry on a commercial footing in New Zealand are being followed with great interest in that dominion. Until a few years ago, the growing of the tung oil tree was confined to China, but the American plantations are new reaching the profit-earning stage and it is from these that the promoters of the New Zealand schemes have secured their seeds.

Commercial planting in New Zealand has not extended over a long enough period for the trees to have reached the nut-bearing stage, but there is every indication from the growth already made that both the soil and the climate are well suited to their needs. Two large companies have started operations this year in the north of the dominion, and efforts are being made to interest farmers in the surrounding districts to take up the cultivation of the trees as side-lines to their normal activities. There are indications, therefore, according to the expectations of the promoters, that New Zealand will have a new industry of prime importance.

Olive Oil Report

(*From Page* 181)

to reject the coin test because of its failure to show that amount. That is why, in this report I have omitted tests made on smaller amounts, on which there are conflicting opinions. If we try to make the test quantitative, we are apt to defeat the purpose. A positive test on the coin or the benzoate is clear enough evidence of the presence of sulfur extracted oils, even though a negative test may not prove that such oils are not there.

We have all agreed on the Beilstein test. We have reached substantial agreement on the iodine test on sample No. 4, and, therefore, conclude that the method of the A.O.C.S. is satisfactory as applied to olive oils, with the time element a factor in the achievement of closely agreeing results.

We, therefore, recommend to the consideration of the Uniform Methods and Planning Committee, the incorporation into the methods sanctioned by the A.O.C.S., the following tests:

1. The Beilstein test for the detection of halogenated solvents in oils, (this for oils in general, not just for olive oil).

2. The Silver Coin test for "Sulfur Olive Oils" or Carbon Bisulfide Extracted Olive Oils.

3. The Silver Benzoate test for "Sulfur Olive Oils" or Carbon Bisulfide Extracted Olive Oils.

These tests are herewith appended, as recommended.

1. *Beilstein Test for the detection of halogenated solvents in oil.* A copper wire that has been previously heated in the Bunsen flame until no green color is imparted, is then dipped into the oil to be tested. It is then placed in the flame. Any traces of chlorine in the oil will give a strong green color to the flame.

2. *Coin Test for Sulfur Olive Oils (Carbon bisulfide extracted).* Pour approximately 20 cc. of the oil to be tested into a large test tube. Suspend a bright new dime by means of a glass rod so shaped for the purpose, or upon broken pieces of glass, in such a way that it is completely surrounded by the oil. The test tube is then placed in an oil bath and so heated that the oil in question reaches a temperature of 210° C., within one-half hour. Maintain this temperature for at least ten minutes longer. After cooling, the coin is examined for color. If it is definitely tarnished or blackened, the test is positive and indicates the presence of sulfur compounds in the oil tested.

3. *Silver Benzoate Test for Sulfur Olive Oils (Carbon bisulfide extracted).* Heat 5 cc. of the oil to be tested in a small test tube placed in an oil bath already at a temperature of above 150° C. so that the oil in the test tube reaches this 150° C. in five minutes at the most. This is to prevent scorching of the oil or undue contact with heat, as the silver benzoate test is a sensitive one. The tube is removed from the bath. A pinch of powdered silver benzoate is dropped into the oil and shaken at once. Any sulfur compounds present will almost immediately darken the oil appreciably as compared against the same oil untreated with benzoate but heated at the same time to the same degree of temperature.

Fish Oil for Poultry

The development of biologically tested sardine oil for use as a substitute for codliver oil in poultry feeding has been undertaken on the Pacific coast. As yet no commercial quantities of the oil are on the market, but at least one producer and one large dealer are working on the idea. It is understood that tests conducted by the producer, a large California fishing concern, have been very satisfactory and the head of the fish oil department of the large dealer mentioned is now in New York, presumably in the interests of further development work along this line.

It was stated by one man closely connected with fish oils that the sardine oil so tested and found satisfactory for poultry use will easily bring 50 cents per gallon, against approximately $1.50 per gallon for poultry codliver oil and 22 cents per gallon for ordinary sardine oil.

The Standards and Research Committee of the Mayonnaise Manufacturers Association held its spring meeting at the Hotel New Yorker, New York, on Thursday, April 9. The subjects discussed included metal corrosion, corn sugar in mayonnaise, colloid mills, the Kreis test, standard methods of analysis and the mayonnaise research fellowship.

In the production of synthetic fats, a mixture of fatty acids containing about 35-65% of saturated fatty acids and the balance unsaturated fatty acids may be esterified by heating with a deficiency of glycerol (suitably under reduced pressure). Brit. Pat. No. 331,880.

OIL & FAT INDUSTRIES

The Editor's Page

Tomorrow's Oil Mill

REPRESENTATIVES of the cottonseed crushing industry assembled at the convention of the National Cottonseed Products Association, at New Orleans during the latter part of last month, listened to several addresses relative to the recently completed economic survey of their industry.

The survey proved conclusively, on paper at least, that the crushing of cottonseed for oil, as conducted at present in the South, is not a profitable business. The plain facts, as expressed by the composite figures from some six hundred mills (covering three years of operation), revealed that the crushers are in the manufacturing business for the benefit of the cotton farmers, who receive the bulk of the mills' earnings in the form of payment for the cottonseed. The best that the mill owners seem to have gained is a fair wage for management efforts.

Various remedies for the situation have been proposed. One which seems to have met with no little favor is that the existing larger and financially stronger mills should buy and scrap the numerous small unprofitable mills. Such a move would, of course, be of little benefit. As soon as the industry as a whole again showed respectable profits, new capital would be attracted, new projects would be initiated and in a short while the same condition on excess milling capacity would reappear.

Earnest efforts are under way, with the able co-operation of the Department of Agriculture, to stabilize a method of grading seed, so that the farmer who delivers poor quality seed will be paid only a percentage of the basic price, thus enabling the crusher to calculate a profit from his operations, even when the yield of oil and ammonia in the form of products is reduced. This step should help the mills appreciably, but as long as the potential seed-crushing capacity of the mills as a whole remains considerably greater than the seed yield of the cotton crop, the old competition for the purchase of seed will persist, with the result that allowances for quality will be remitted and all other considerations of profitable operation may be neglected in the scramble to *get the seed.*

The forward-looking crushers will prepare to keep their mills in operation by adapting them for handling other oil-bearing materials than cottonseed. The development of soy beans in the middle west in the past few years has been remarkable. This crop, as well as peanuts and several other vegetable sources of oil, is well suited to much southern land available for cultivation. Certain imported raw materials, also, can be handled in the cottonseed mills.

The successful mill of the future will be an oil mill, not a cottonseed mill, operating at least three hundred days a year, on a variety of oil-bearing material.

Progress in Oil Chemistry

THE American Oil Chemists' Society has just brought to a close a most successful year. The period was marked by an awakening of interest in one of the most involved problems of research in the chemistry of fats; the nature, cause and control of rancidity.

Rancidity and consequent spoilage of edible fats and bakery products is responsible for the loss of millions of dollars annually in this country alone. For many years chemists and bacteriologists have considered the subject only in a desultory manner, usually arriving at the point of admitting that the cause or causes were just beyond detection.

Now, however, with the advent of new apparatus of various types for the measurement of the progress of oxidation and rancidification, investigators are viewing the problem with renewed hope of success.

At the Fall Meeting of the Oil Chemists' Society which was held in Chicago in November last, several valuable contributions to the subject of rancidity and instability of fats, particularly of fats intended

for shortening purposes, were presented. Incidentally, this Fall Meeting, the fourth to be held by the Society, was attended by over a hundred members and visitors, rivalling the Annual Meetings in interest and enthusiasm evoked.

Once again, at the Twenty-second Annual Meeting, just concluded at New Orleans, the "Symposium on Rancidity" brought forth a number of pertinent papers, and held the close interest of a large attendance.

The damaging effects of rancidification are not confined to the fats used for edible and shortening purposes. Wherever in the technical field there is demand for sweet, clean fatty products, the desired results cannot be obtained with fats or oils which have become subject to the taint. This is particularly true where the resulting product is paint, varnish or other surface covering, or soap.

In a laudable effort to extend the scope of its influence, the American Oil Chemists' Society has voted at its recent meeting to extend to the Fall Meetings equal powers of study and review of proposed analytical and research methods with that formerly belonging only to the Annual Meetings held in the South in the spring of each year. The Fall Meetings are held in the Middle West or East and are therefore more accessible to chemists and technologists from the industrial centers of the country.

A new drive for membership is being launched by the society, and the advantages of membership for every chemist who is in any way connected with scientific or technical work on fats, fatty oils, soaps or allied products are manifold. The Official Journal of the Society, which is mailed monthly to every member, reports the progress of the society's analytical and research work. The opportunities for direct contact with others engaged in similar work offered by the two meetings each year are invaluable. The cooperative analytical program of the Society offers oil chemists a tangible means of verifying the accuracy of their analytical work. Membership in the society is a recommendation to employers of a chemist's qualifications in his chosen field. Every chemist should belong to the American Chemical Society. Every one working with fatty products or soaps should belong also to the American Oil Chemists' Society.

The corporate name of Emery-Drew, Inc., has been changed to Wecoline Products, Inc. The offices of the corporation are maintained, as heretofore, at 122 East 42nd St., New York City. The stock interest formerly held by Emery Industries, Inc., has been purchased by E. F. Drew and Co.

A news report from Moscow states that the Soviet Union plans to spend 300,000,000 dollars in buildings and equipment for the food industries this year, paying special attention to sugar, flour, vegetable oils and fisheries.

Joseph M. Wafer has been appointed Assistant Sales Manager of Industrial Chemical Sales Company. Mr. Wafer was formerly advertising manager of the same company and more recently Eastern sales manager of American Solvents and Chemical Corporation.

The State Law Reporting Company, of New York City, has been appointed official reporter of the Federal Trade Commission, for the reporting of all the hearings of the commission throughout the United States, including the investigation of the cottonseed industry now being conducted. Anyone interested in a transcript of the proceedings of cases heard before the commission or the testimony of a particular witness may purchase such transcript from the official reporter.

Hellmann Mayonnaise Company, a subsidiary of General Foods Corporation, is extending its advertising to the radio field with a series of concerts over the National Broadcasting System. The programs are broadcast daily from Monday to Friday inclusive, starting June 1, from 12:00 Noon to 12:15 P.M.

CHEMIST — Young man experienced in soap, oil and fat trades desires position. Has had charge of laboratory. Location in New York preferred. Address Box 708, care *Oil & Fat Industries.*

Position Wanted: Capable executive, qualified by training and experience as General Manager or Sales Manager of edible oil refinery, compound or margarine business. Experience covers general management in such lines, including all edible oil specialties, coconut butters, salad oil, mayonnaise, margarine, shortening. Address Box A12, % *Oil & Fat Industries,* 136 Liberty Street, New York, N. Y.

Richardson Elected Chemists' President

Twenty-second Annual Meeting Featured by Method Revisions, By-Law Changes and Constructive Scientific Papers

THE American Oil Chemists' Society has brought to a close another year of most successful progress under the leadership of President W. H. Irwin.

The Twenty-second Annual Meeting, held at the Roosevelt Hotel, New Orleans, on May 14th and 15th, was attended by nearly one hundred members and guests, representing all branches of research and production in the fields of fatty oil and soap technology.

The outstanding technical papers presented at the meeting dealt with the factors involved in rancidity of fats and oils, and consequent spoilage of food products.

In his Presidential Address, President Irwin recommended that all analytical methods be made tentative for one year before adoption as Official Methods of the Society. He proposed broadening of the powers of the Referee Board and that the Fall Meeting shall be made an annual event, with powers of rule and method recommendation coequal with those of the Annual Meeting held each spring. President Irwin's address appears in full elsewhere in this issue of *Oil & Fat Industries.*

The Minutes of the meeting were as follows: The meeting was called to order by E. G. Williams, Chairman of the Local Arrangements Committee, after which Invocation was pronounced by Father Doonan of Loyola University of the South. The meeting was then officially declared to be in session by President Irwin.

On vote of the members present, the reading of the minutes of the last Annual Meeting was dispensed with. Archibald Campbell, Fourth Vice-president took the Chair during the delivery of President Irwin's Presidential Address. On motion, approved, the address was submitted to a committee appointed by the Chair, for study and a subsequent report to the meeting.

A. S. Richardson
President
American Oil Chemists' Society

President Irwin having resumed the Chair, J. C. P. Helm, Secretary and Treasurer, submitted his annual report for the year 1930-31. The report was accepted and referred to an auditing committee.

The Secretary also submitted the report of the Governing Committee and read the minutes of the two most recent meetings of that com-

mittee, in which were contained the following proposed amendments to the By-laws of the society:

Article 5. Section A, to read as follows:

"The Society shall meet twice annually—Spring and Fall. The Spring Meeting shall be known as the Annual Meeting of the Society; and shall be held at the same place selected by the National Cottonseed Products Association, within one week of the meeting of the National Cottonseed Association.

The Fall Meeting shall be held at a place and time decided upon by the Governing Committee; and shall have equal powers as to making of rules and adoption of methods, as at the Spring or Annual Meeting.

Due notice, of the time and place of each meeting, shall be sent to the membership by the Secretary of tne Society."

Add as Article 9; Section A.;

Adoption of Methods

"Methods of Analysis offered, if adopted, shall be 'Tentative Methods,' for a period of one year; after which they may be adopted as 'Official Methods,' at any subsequent meeting of the Society."

On motion of H. P. Trevithick, seconded by C. B. Cluff, and carried, the minutes read, including the above amendments, were adopted by the Society.

The report of the Membership Committee was given by J. C. P. Helm, Secretary, and ordered accepted. The report of the Soap Section, submitted by Archibald Campbell, Chairman, was accepted and referred to the Uniform Methods and Planning Committee, as was the Soap Committe report, which was presented by H. P. Trevithick, Chairman. The report of the glycerine committee, in the absence of J. T. R. Andrews, Chairman, was presented by W. J. Reese, accepted and referred to the Committe on Uniform Methods and Planning.

A very interesting paper on "Mammy Apple Seed Oil" was presented by Geo. S. Jamieson, Chemist in Charge of the Oil, Fat and Wax Laboratory, U. S. Department of Agriculture.

W. J. Reese, Chief Chemist, Colgate-Palmolive-Peet Company, Kansas City, delivered a paper on "Plant Accounting as a Field for Chémists." The thanks of the Society were tendered Dr. Reese for his able presentation of his subject.

The reports of the Cottonseed Analysis Committee, C. H. Cox, Chairman, and the Committee on Crude Mill Operations, Andrew K. Schwartz, Chairman, were presented by these members, respectively. The report of the Sampling Committee was read by J. P. Harris, in the absence of C. E. Serbell, Chairman. All of these reports were referred to the Committee on Uniform Methods and Planning.

J. G. Gibson presented a paper on "The Forming and Pressing of Cakes," which was accepted with the thanks of the Society.

A verbal report was tendered the Society covering the conference recently held in New York under the guidance of the American Optical Society, looking toward the formation of an "Inter-society Council on Color Specification."

The reports of the Color Committee, W. D. Hutchins, Chairman, Refining Committee, C. B. Cluff, Chairman, and Solvents Committee, R. H. Fash, Chairman, were received and referred to the Uniform Methods and Planning Committee.

The report of the Smalley Foundation Committee, A. W. Putland, Chairman, was read by L. C. Haskell. The thanks of the meeting were tendered Thomas C. Law for his efficient work in the preparation and despatch of the Smalley Foundation Check Meal Samples during the past year, as also handled by him in former years.

A paper on "Seed Sampling" by E. C. Ainslie was read by C. B. Cluff, in the temporary absence of Mr. Ainslie.

President Irwin announced the Nominating Committee: J. J. Vollertsen, Chairman, J. J. Ganucheau, H. P. Trevithick, G. K. Witmer, and H. L. Thomas; the Resolutions Committee: E. R. Barrow, Chairman, Archibald Campbell and J. P. Harris. After announcements concerning the entertainment program, the Meeting adjourned until the following morning.

Second Day's Session

THE first business of the second day's session, May 15th, was a general discussion of proposed changes in methods, particularly those pertaining to cottonseed. The discussion was led by Thomas C. Law, Chairman of the Chemists' Committee of the National Cottonseed Products Association.

The first paper presented was entitled "Some Aspects of Seed Grading" by Andrew K. Schwartz. H. P. Trevithick presented a paper, "Halphen Test on Kapok Oil," by H. P. Trevithick and W. H. Dickhart.

The report of the Referee Examining Board was presented by W. H. Irwin, Chairman, with comments by the Chairman upon the results obtained by referee chemists on check samples submitted to them during the year.

The report of the Olive Oil Committee, M. F. Lauro, Chairman, was presented by H. P. Trevithick and referred to the Com-

mittee on Uniform Methods and Planning. The report of the Moisture Committee, N. C. Hamner, Chairman, was also referred to the Uniform Methods Committee, after considerable discussion on the subject of moisture ovens. Other committees reporting were those on Basic Research, E. R. Barrow, Chairman; Publication of Methods, W. H. Irwin, Chairman; Kreis Test, A. S. Richardson, Chairman; and Uniform Methods and Planning, J. J. Vollertsen, Chairman.

Papers presented on May 15th included, in addition to those mentioned previously: "Isolation of Compounds Giving Rise to Kreis Color Reaction," a contribution from the Mayonnaise Manufacturers' Association, by Lowell B. Kilgore, *Research Fellow;* "Measurements with the A. P. C. Photoelectric Spectrophotometer" by Monroe Barnard and Paul McMichael; "The Rancidity Effect of Various Layer Boards on Shortening" by W. Rabak; "The Hydrogenation of Lard" by M. H. Gwynn and Alan Porter Lee.

The report of the Resolutions Committee was presented by E. R. Barrow and the following resolutions were adopted by the Meeting:

Whereas, The American Oil Chemists' Society is privileged to hold its 22nd Annual Convention in New Orleans and enjoy this city's famed hospitality and Whereas, The members of the local committee have arranged a most enjoyable and entertaining program, Be it resolved, That The American Oil Chemists' Society express its hearty appreciation and sincere thanks to Mr. E. G. Williams and the members of his committee, and to Mrs. W. D. Reid and the members of her committee for the delightful program of entertainment provided for the Society. Be it further resolved That the thanks of the American Oil Chemists' Society be tendered the management of the Roosevelt Hotel for their splendid co-operation and many courtesies. Be it further resolved That the American Oil Chemists' Society express its deep gratitude to the Officers and Committee Chairmen who have given their unselfish and untiring efforts on behalf of the Society, and for the constructive and interesting programs arranged for its meetings.

Whereas the indiscriminate use of the Kreis test has resulted in the condemnation of many vegetable and animal oils and fats which were perfectly sweet, and whereas the results of the study made by the Kreis Test Committee of the American Oil Chemists' Society over a period of three or four years have been discordant, be it resolved that the American Oil Chemists' Society go on record as stating that there are no chemical tests which may be depended upon to accurately forecast the keeping properties of vegetable and animal oils and fats, and that in the final analysis only the sense of taste and smell should be taken as a guide to serve for the rejection or acceptance of these products.

The Resolutions Committee was directed to prepare suitable expressions of the Society's regret for the loss of the two members deceased during the past year, Miss Rosalind U. Norris, Chief Chemist of Hellmann Mayonnaise Company, and Raymond M. Miller, Sales Manager of Arthur H. Thomas & Co., and to forward copies of such resolutions to the bereaved families.

The officers for the coming year proposed by the Nominating Committee, and unanimously elected by the Membership present, were:

President, A. S. Richardson; 1st Vice-president, N. C. Hamner; 2nd Vice-president, J. C. McMillan; 3rd Vice-president, Andrew K. Schwartz; 4th Vice-president, and Chairman Soap Section, Archibald Campbell.

There being no further business the Meeting was adjourned, all those present concurring in voting the Twenty-second Annual Meeting one of the most profitable and enjoyable among the Society's gatherings.

Entertainment Features

THE entertainment provided for members and guests at the Meeting included the Annual Golf Handicap Tournament, a luncheon and bridge party in honor of visiting ladies, held at the Pirate's Chest, an attractive tea room in the Vieux Carre, and the Annual Banquet.

The golf competition was held this year at the West End Country Club and brought out an imposing array of contestants at the ancient and honorable pastime of St. Andrew's. The Tournament Committee, consisting of N. C. Hamner, *Chairman,* J. J. Vollertsen and H. P. Trevithick, had, by diligent effort, assembled a most attractive series of prizes, so that every golfer was assured in advance that conscientious application to the matter in hand might be well rewarded.

When the tumult and the shouting had died and the dust and sand from divot and trap had blown away, the following players were found tightly grasping prizes as listed below. The names of prize donors are also given, as well as the score recorded by each prize winner.

Low Gross:	Donor	Winner	Score
1. Challenge Cup and Medal	Nuchar Co.	L. B. Forbes	87
2. Golf Bag	Filtrol Co.	J. J. Trunzler	91
3. Dozen Balls	L. C. Haskell	N. C. Hamner	98

Low Net:			
1. Matched Wood Clubs	Bennett-Clark Co.	R. C. Hatter	72
2. Dozen Balls	Laboratory Constr. Co.	L. C. Haskell	73
Blind Bogie, (78):			
1. Matched Clubs	United Gas Co.	E. B. Freyer	78
2. Gladstone Bag	Peerless Clay & Minerals Co.	W. H. Irwin	77
3. Golf Bag	Emil Greiner, Inc.	E. R. Barrow	76
4. Dozen Balls	Peerless Clay & Minerals Co.	C. B. Cluff	76
5. Chemists' Slide Rule	Eimer & Amend	J. J. Vollertsen	81

As an innovation this year the Annual Banquet took the form of a Dinner-Dance, held at the Luzianne restaurant in the French Quarter. Under the influence of delightful music, a splendid dance floor, and with the inspiration of many beautiful and charming Orleaneans and visiting ladies, many of our leading members were seen demonstrating their ability at Terpischore. Thomas C. Law acted as Toastmaster and Master of Ceremonies, filling the part with his usual éclat. The only speeches of the evening were short addresses by the retiring and incoming presidents. All present declared this Dinner-Dance to be the most successful entertainment ever held by the Society.

Auditing Committee

By oversight the report of the Auditing Committee was not presented at the Annual Meeting of the American Oil Chemists' Society in New Orleans, but was presented at a meeting of the Governing Committee on May 15th.

On this account President Richardson has requested that the report of the committee be published in full in *Oil & Fat Industries* for the information of all members of the Society, including those who attended the Annual Meeting. The report follows: Mr. President: Your auditing committee have examined the books of Mr. Helm and found everything in order. Mr. Helm is to be commended for care and neatness which he has exercised.

Sgd. G. K. Witmer, *Chairman*
Chas. W. Rice
G. A. Moore

Chemical Industries Exposition

THE Thirteenth Exposition of Chemical Industries was held at the Grand Central Palace, New York, May 4 to 9, with nearly four hundred manufacturers of machinery, equipment and materials exhibiting the most recent developments in their respective fields. On Thursday evening, May 7, the Seventh Annual Chemical Industries Dinner was held at the Hotel Roosevelt. Arthur D. Little was the speaker of the evening. The exhibits at the Exposition which were of particular interest to the readers of *Oil & Fat Industries* were:

Beach-Russ Company: A complete line of laboratory and plant vacuum pumps, air compressors and pumps. Representatives in attendance were C. A. Beach, A. T. Beach, H. C. Russ and H. F. Kleinfeldt.

Eimer & Amend: Chemical laboratory apparatus, including balances, viscosimeters, A.P.C. spectrophotometer and opacimeter and their general line of laboratory glassware and chemicals.

Darco Sales Corporation: Exhibited apparatus demonstrating the purifying power of Darco on oils and fats, as well as many samples of fatty products before and after treatment with Darco. L. M. Gill was in charge of the exhibit.

Christian Becker, Inc. and Torsion Balance Co.: Precision balances and weights and torsion balances, featuring special balances for free fatty acid determination, in charge of A. T. Millroy.

Fred S. Carver: Laboratory hydraulic presses equipped with accessories for pressing oils, parting stearines, filtering liquids from sludges, etc. Mr. Carver was in attendance, assisted by H. H. Fromen and W. H. Barrington.

Pfaudler Company: Exhibited glass-enamel lined tanks, mixing tanks and stills in great variety. Exhibit was in charge of H. R. Hanson.

Industrial Chemical Sales Co. Exhibited Nuchar decolorizing carbon, Diafilt filter aids, Clarex and Petrolex activated bleaching earths. J. W. Wrench was in charge of the exhibit.

Turbo Mixer Corporation: Exhibited turbo-mixers, gas absorbers, heat exchangers, laboratory mixers, hydrogenation and deodorizing equipment accessories. Exhibit in charge of J. E. Moul.

Central Scientific Company: Displayed vacuum drying ovens, forced draft ovens, triple beam balances, vacuum pumps, sillimanite laboratory ware and other items of laboratory apparatus. H. V. Cadwell was in charge.

Patterson Foundry and Machine Company: All types of mixing machinery, plain and jacketed soap crutchers, filter presses and pumps. D. H. Wilhelm was in charge.

President Irwin's Convention Address

Oil Chemists' Leader Stresses Need of Increasing Membership and Revising Procedure in Adoption of Methods

By W. H. IRWIN, *Retiring President*

FELLOW Members of the American Oil Chemists' Society, Guests, and Friends: It has been customary, for many years, for the President of the Society to make an address at the Spring Meeting. I am not sure whether the thought in this is to punish the President or the members of the Society. It probably serves both purposes.

My address today will consist principally of a review of the progress of the Society and recommendations for certain changes in our procedure, etc. The year 1930-31 has been a strenuous one in more ways than one. However, I think our Society has made satisfactory progress under the circumstances. Our membership has remained about the same as the preceding year, and our finances, as shown by the treasurer's report, are in good shape.

W. H. Irwin

Organization

I BELIEVE most of you are familiar with the fact that our Society was organized in 1909 with Felix Paquin as first president, and was known as the Society of Cotton Products Analysts. Later it was decided to expand our activities and to include the study of methods for all vegetable and animal oils and fats. In 1920 the name of the Society was changed to the American Oil Chemists' Society, and in 1927, at the suggestion of the president, Mr. H. P. Trevithick, a Fall Meeting was authorized by the Governing Board. At this meeting, held in New York City, a Soap Section of the Society was organized, thus further expanding the activities of our Society.

The expansion of the activities of our Society, however, has not resulted in the increase in membership which we had reason to expect. The fault probably lies in the fact that there has been no concerted effort to increase our membership. There are hundreds of chemists engaged in oil, fat and soap work who are not members of our organization. I believe that many of them would willingly join if they were invited to do so by a member of the Society. I therefore suggest, for the consideration of the next Membership Committee, that it might be a good plan to obtain a list of the various manufacturers engaged in the oil, fat and soap industries and have a thorough canvass made of their laboratories with a view of increasing

our membership and thus enabling us to do more and better work along oil, fat and soap lines.

In endeavoring to interest other organizations in our Society I wrote to Mr. Glenn H. Pickard, President of the National Soybean Manufacturers' Association, inviting the chemists of their organization to join our Society and suggested the adoption of our methods as the Official Methods of their organization. Mr. Pickard replied as follows:

> "I have looked over the methods of analysis and find that for the most part they check exactly with the ones that we are using. I see absolutely no reason why the National Soybean Manufacturers' Association cannot, in their specifications, define their methods as those of the American Oil Chemists' Society. All I can say at this time is that at the next meeting of the Standards Committee I will present the matter to the members and will have copies of the methods of the Oil Chemists' Society with me."

There have been, in times past, a number of suggestions that our body should become a section of the American Chemical Society, and while I believe every chemist should belong to the American Chemical Society, I think it would be a grave mistake for the American Oil Chemists' Society to affiliate itself with the American Chemical Society. The American Chemical Society is so enormous at the present time and its activities are so varied that we would be lost sight of and would not be able to accomplish what we have and are accomplishing as an independent organization. Therefore, it is my thought that we should endeavor to increase the number of members in our own organization rather than to affiliate with the American Chemical Society.

Meetings

AT THE present time provision is made in our constitution and by-laws for only one meeting of the Society each year, but by vote of the Board of Governors a Fall Meeting has been authorized for the past four years. This Fall the Society held its Fall Meeting in Chicago. At this meeting we had a very large attendance and much interest was taken in the many interesting papers given. It is my thought that, in view of the interest displayed in the Fall Meetings, the Society should make provision for a regular Fall Meeting of the Society. The meeting should be held preferably somewhere in the Middle West in order to attract chemists from all parts of the country. It should also be given the same powers for the adoption of methods, etc., as the Spring Meeting.

I also think the Spring Meeting can be made more interesting if we arrange to have our Committee Reports printed in the April issue of *Oil and Fat Industries*. This will afford each member of the Society an opportunity to read and be prepared to criticize the methods when they are offered for adoption. It would then only be necessary for the Committee Chairman to read a synopsis of the work and the recommendations of his Committee. This plan would not only permit of more deliberate action in the adoption of methods, but would also result in giving us more time on our program for papers of interest to the industry.

Methods

THE machinery and mode for the adoption of chemical methods is not all that could be desired. Many times, through necessity, we adopt methods as Official Methods, which have not been given as thorough a study as they should receive. For example, the Seed Grading Plan which was put into effect last year has resulted in a large increase in the amount of chemical work, and certain changes have been found to be necessary in the methods of analysis. This plan, like every other new plan, has encountered considerable opposition and difficulty, but we should all strive to see that our analytical methods are such that differences between laboratories will be few and far between. I therefore wish to recommend to the society that our methods be made tentative for one year before they are adopted as official in order that the proper consideration may be given them before they are included as official in our book of methods.

Referee Board

IT HAS been suggested by some members of the Society that the Referee Board be abolished in view of the fact that the National Cottonseed Products Association appoints Official Chemists, but I, personally, am not ready to agree that this is a good move. We are an independent scientific society, trying to serve the entire oil and fat industry, and I am sure the Referee Board has served, and still serves, a useful purpose. It is my thought that we should broaden the powers of the Referee Board if necessary, and grant certificates to Referee Chemists not only on vegetable and animal fats and oils, but also on soaps, etc., and soap products. Another point of value is that all Referee Chemists are required to participate in the Smalley Foundation work and this not only gives us a line on the kind of work they are turning out, but also provides some revenue to the American Oil Chemists' Society.

Color

THE matter of manufacture of satisfactory color glasses in this country should be given prompt attention. The present situation is intolerable and it does not reflect credit on the American chemists to endure the present situation. It is almost impossible to get color glasses in a reasonable length of time and after they are secured the variation is so great that it is necessary to have them standardized, at considerable expense.

I took it upon myself to write one manufacturer of color glasses for Ph work to see whether we could interest them in the manufacture of Lovibond glasses, and have found them eager to cooperate with us in the production of satisfactory color glasses. I think from this point on the matter should be handled by our Color Committee.

In January I received a letter from the President of the Optical Society of America asking me to appoint a delegate to attend a preliminary meeting to be held in New York in February. I appointed Mr. H. P. Trevithick, and Mr. A. P. Lee acted as his alternate. A short report covering this meeting will be given later by Mr. Lee.

Kreis Test

THE indiscriminate use of the Kreis Test has resulted in the condemnation of many oils and fats which are perfectly sweet and bland. Our Kreis Test Committee will probably have some recommendations to make, but for the information of those present, I wish to quote a resolution adopted by the German Committee on Fat Analysis April 14, 1930 covering their views of the Kreis test.

"Whereas the determination of deterioration (rancidity) is uncertain, and whereas the color reactions now in use for this purpose are unreliable, therefore it is resolved that odor and flavor remain the only decisive tests. Because at the present stage of scientific development no uniform conclusions can be drawn from colorimetric tests as regards the rancidity of fats, therefore none of the now known reactions can be prescribed with responsibility as 'Standard Methods.'"

Some similar action by this body would, in my opinion, have a very beneficial effect on the oil and fat industries.

Journal

I THINK we all will agree that our Journal, at the present time is making progress, but I think we could all do more than we have done in the past toward the financial success of the Journal. This would enable them to give us a better Journal by arranging the advertising so that the pagination of scientific numbers is continuous. With this point in view, I recommend that every purchaser of chemical equipment mention the Journal in making purchases and also mention the Journal as an advertising medium to salesmen visiting their laboratories.

In closing my remarks, I wish to thank the Society for the honor conferred upon me and to express my appreciation of the coöperation of all of the Officers and members of the various committees. It has been a pleasure to serve as your President during the past year.

Summary of Recommendations

1. That the Membership Committee obtain a list of manufacturers engaged in oil, fat, and soap industries and make a thorough canvass of their laboratories with a view of increasing our membership.
2. Authorize a Fall Meeting of the American Oil Chemists' Society as a regular meeting of the Society, this meeting to be held somewhere in the Middle West.
3. Arrange, as far as possible, for the publication of Committee Reports in advance of the meeting in order to allow a more intelligent discussion of methods offered for adoption.
4. Adopt all methods as "tentative" for one year before making "Official."
5. Continue the Referee Board and enlarge its powers.
6. Make a determined effort to have color glasses manufactured in this country under suitable scientific management.
7. Take definite action in the form of a resolution on the inapplicability of the Kreis Test as a criterion of rancidity.

Lewis Heads Chemists' Club

G. C. Lewis, Vice president of Darco Sales Corporation and Technical Director of Columbian Carbon Company has been elected President of the Chemists' Club of New York for a term of two years, succeeding L. V. Redman, of the Bakelite Corporation.

Experiments in the shipment of oil-containing tropical products in pressed bales are said to have resulted favorably in the case of copra, but very unfavorably in the case of peanuts and that of rubber-seed kernels, as both the latter products suffered from the compression into bales and the free fatty acid content of the oils was considerably increased. *Ber. Adf. Handels. Ver. Kolon. Inst.* No. 56, 28 pp. *Chem. Abstr.* 25,2582, (1931).

National Cottonseed Convention

Economic Survey and Relations with Planters Outstanding Subjects of Discussion at New Orleans

THE thirty-fifth annual convention of the National Cottonseed Producers Association was held at the Roosevelt Hotel, New Orleans, Louisiana, May 18th to 20th.

Officers elected for the coming year were: President, Philip Rucker Lamar, of Rome Oil Mills, Atlanta; vice-president, V. P. Doughtie, of New South Mills, Helena, Arkansas; treasurer, George H. Bennett, Dallas, Texas.

In his presidential address, W. A. Sherman, the retiring president, stated that the cottonseed crushers had encountered hindrance where they had expected help through the investigation of the industry being conducted by the Federal Trade Commission. The Department of Agriculture, on the other hand has been of immeasurable assistance to the industry in research work and in disseminating educational data.

Mr. Sherman urged that the widest use be made of the findings of the recently completed economic survey of cottonseed and its products. Overcapacity of mills or presses was presented as one of the cottonseed products industry's major problems in the report of this survey of the industry. The survey disclosed that during the three-year period, 1927 to 1930, the oil mills had an average net profit of only 44 cents per ton, which the report declares "inadequate to maintain the industry."

The survey showed the total revenue from the sale of products by the mills during the three-year period to have been $752,154,086. Of this, $499,079,131, or 66.4 percent, went to Southern farmers who grew the seed. The seed merchants got 10.1 percent of the total revenue for the three-year period. The total net profits of the mills for the three years was listed as $6,481,547. This, the survey pointed out, was but nine-tenths of one percent of the total three-year revenue. The net profit of the mills, averaged 85 cents per ton in the first year; their operations showed an average net loss of 9 cents per ton in the second year and a net profit of 59 cents per ton in the third year covered by the survey.

The survey showed for the industry an over-capacity of between 50 and 60 percent, expressed in terms of presses, and presented data indicating there is not seed enough to keep all the mills in steady operation for much more than four months of the year. Figures were presented showing that conversion costs decreased substantially and profits increased in direct relation to the size of crush per press. The report said that, on the average, a minimum crush of 1,750 tons per press was required to enable the mills to "break even."

Another problem of the industry stressed in the report was "the lack of comprehensive public current market reporting facilities for cottonseed, such as obtains for other farm products." These conditions, the report said, affect not only the mills but even more those who produce the seed.

The grading rules adopted last year were too intricate, and did not form an accurate basis for trading in the light of experimentation, G. S. Meloy, senior marketing specialist of the United States Department of Agriculture, told the crushers. This was due in part, Mr. Meloy said, to the fact that cottonseed produced last year was not normal. He recommended 17-percent oil content in place of the 19-percent basis for grading in use during the past year, and offered a simplified algebraic formula representing oil content plus ammonia content as a quantitative index, and a basic percentage figure of 100 as a prime qualitative index (reduced 8 percent for bolly seed) as a guide for grading, the grade to represent the combined quality and quantity indexes. This was offered as a basis for the simplification and changing of rule 40, section 4, as a step toward the popularization of seed grading. Mr. Meloy defended free fatty acids analysis as representing a saving of one-third, on the average, to sellers, in comparison with the color-of-kernel method of determining deterioration in cottonseed shipments.

Technical Emulsions of Oils and Waxes with Water

Careful Technique and Selected Emulsifying Agents Required in Preparation of Commercial Products

By H. BENNETT*

CHEMICALLY a more or less permanent mixture of an oil, fat, wax or other water insoluble medium and water is termed an emulsion. Before an emulsion can be prepared it is necessary to introduce a third factor known as an emulsifying agent. A typical emulsifying agent is ordinary soap. A simple experiment to illustrate a typical emulsion is to place a little linseed or other oil in a bottle and then add to it some water containing some soap. On shaking vigorously the mixture becomes milky and the oil and water do not separate at once, as would be the case if the soap were not present. This experiment can be performed on a smaller scale to better illustrate this phenomenon. If a drop of oil be placed on the surface of a glass of water it will remain in one round globule. If now a little strong soap solution is poured down the side of the glass the globule will begin to spread until it covers all of the surface of the water. This is emulsification of the oil and water by means of the emulsifying agent, soap.

For technical purposes the maker of emulsions has many factors to consider. In products which are not used immediately the "life" of the emulsion is extremely important. If a commercial product will not be used for three to six months it must be so prepared that there will be no separation during this period. An emulsion which does not separate in a given length of time is referred to as a stable emulsion. Many an emulsion when freshly made lifts its maker to the zenith of exultation but shortly drops him to the nadir of despair when it separates.

While the theory of emulsions is prolific with mathematical equations and observations made during the course of pure research, the practical side of formulation as applied to the manufacturing industries has been sadly neglected in the literature.

Before proceeding with practical working formulae for producing emulsions of every day interest and use mention must be made of some of the pitfalls encountered by the maker of emulsions. Since emulsions are by nature more or less unstable every care must be taken to produce them under optimum conditions and eliminate all deleterious and disturbing factors. Once a formula is established careful note must be taken of the amounts of each ingredient used, the rate of introduction and the order of introduction of each element, the kind and rate of stirring, temperature, time, and type of mixing apparatus must be duplicated exactly or the finished emulsion will not be perfect.

For the past three years the writer has devoted considerable time toward developing methods for the production of stable emulsions, particularly of carnauba wax which is used in so many polishing preparations. All of the known emulsifying agents were tried with more or less success. Complete success was not achieved however until ammonium linoleate was tried. Because previous processes for the manufacture of ammonium linoleate were rather costly this efficient emulsifying agent was neglected. A low priced process for making ammonium linoleate was developed which enables its production at a price so low that it can be used in the lowest priced emulsions.

Since it was found that better results were gotten by using an ammonium linoleate not especially purified, one containing ammonium salts of the homologous acids of the linoleic series, the product now used is called ammonium linoleate paste which contains about 20% moisture. It is a cream or tan colored, grease-like material, soluble in water and alcohol.

* *Laboratory of Glyco Products Co., Inc., Bush Terminal, Brooklyn, N. Y.*

Since it is chemically a soap the usual precautions must be observed—the avoidance of acids, salts and other precipitants.

Procedure

USING proportions given in table, first dissolve the indicated amount of water in the ammonium linoleate. This is done by covering the ammonium linoleate with the required amount of water and allowing it to soak over night. Work in slowly the next day until dissolved completely. Do not attempt to dissolve in any other way or lumps will result. To this add slowly with vigorous agitation the indicated amount of oil and continue stirring until homogeneous.

The technique for making wax emulsions is similar except that heating must be resorted to. To make a wax emulsion, dissolve the ammonium linoleate paste according to the above method. Place this solution in a pot and heat to 95-98°C. Simultaneously with this procedure melt the wax in another pot and heat to 100-105°C. As soon as both solutions are at the indicated temperatures, start the high speed stirrer in the pot containing the ammonium linoleate solution in water and run in the wax in a thin stream. In order to prevent excessive evaporation of water, the pot should be covered while stirring. Stirring should be continued until the emulsification reaches the best of results. Lengthy stirring can do no harm and can do much good. At the risk of reiteration emphasis must again be placed on the temperatures indicated above. An extreme lowering of temperature will produce a grainy effect brought about by the crystallization of wax. A fast electric stirrer is essential in producing good wax emulsions.

Very often it is desired to emulsify a solid material which melts above 100° C. Since such a substance would crystallize on touching even boiling water a simple stratagem is resorted to. The solid substance is dissolved in an oil or hydrocarbon and this solution is treated just as an oil or hydrocarbon is handled. Thus a fossil resin may be dissolved in naphtha and emulsified without the use of heat. Similarly high melting water soluble substances are dissolved in the water used in the emulsion.

Beautiful colored effects are produced in many emulsions by dissolving a water soluble dye in the water used. These colors are enhanced in beauty by the milky appearance and give many novel shades and nuances of color.

Many polishing emulsions contain abrasives and pigments. Since these latter materials have a higher specific gravity than water they will tend to settle out. In order to prevent or slow up the attraction of gravity for these particles the emulsion should be made as viscous as possible. The table given below gives a number of formulae for making various emulsions. In following these formulae it may be found that in some cases slight variations in the amount of emulsifying agent used may be necessary because of natural variations in the oils, waxes etc. (It is a well known fact that all naturally occurring organic materials show periodic variations.)

FORMULAE
(All Parts by Weight)

No.	Material Emulsified	Parts	Parts of Water	Ammonium Linoleate Parts
1.	Pine Oil	90	90	10
2.	Kerosene	90	90	8
3.	Naphtha	90	100	7
4.	Benzol	90	100	7
5.	Gasoline	90	100	7
6.	Cottonseed Oil	90	90	11
7.	Linseed Oil	90	150	8
8.	Olive Oil	80	60	10
10.	Castor Oil	90	80	12
11.	Citronella	90	90	10
12.	Chinawood Oil	90	80	12
13.	Peanut Oil	90	80	12
14.	Coconut Oil	90	80	12
15.	Paraffin Wax	90	320	24
16.	Carnauba Wax	90	420	12
17.	Asphaltum	40	200	8
18.	Beeswax	90	500	12
19.	Synthetic Wax	90	500	12
20.	Ozokerite	90	400	14
21.	Montana Wax Bleached	90	560	12
22.	Turpentine	90	100	8
23.	Nitrobenzol	90	100	8
24.	Orthodichlorbenzol	90	100	8
25.	Methyl Salicylate	90	100	8

The above formulae can be lessened in cost by reducing the amount of emulsifier used. The minimum can be determined by experiment. Increasing the amount of water will give thinner emulsions.

Formula #1 is typical of ordinary type oil, furniture and automobile polish. This is often given a lemon-like odor by dissolving a little lemongrass oil or lemenone in the oil before emulsification.

Formulae #2-5 inclusive are used for cleaning printing presses and other machinery, wood-work or porcelain.

Formulae #6-14 inclusive are used as lubricants and softeners during textile manufacture; for "stuffing" or rendering leather soft and pliable; for various specialties used in many industries where the use of the oil itself is undesireable or too expensive.

Formulae #15-21 inclusive are used as polishes for furniture, automobiles and for many industrial polishing purposes. These formulae are finding increasing use for lubrication during the processing of silk and rayon.

Formulae #22 and 25 are used for liniments and cleaners. Formulae #23 and 24 are used in shoe and metal polishes.

Many adaptations of these formulae are used for divers purposes. For example the kerosene in formula #2 may be replaced by a kerosene extract of pyrethrum flowers and then serves as an excellent fly spray and insecticide.

Ammonium linoleate emulsions of fatty acids may be used for waterproofing concrete, cement and stucco by diluting these emulsions to varying degrees and mixing them in while forming or applying these structural materials. The ammonia and water gradually evaporate and the lime magnesia present in the cement and sand combine with the linoleic and other fatty acid to form an insoluble metallic soap which is water-repellent.

The bleaching of fats, oils and waxes may be consummated by forming an emulsion of the fat, oil or wax and diluting the same with a large excess of water. There is then introduced a concentrated solution of common salt. The latter causes the emulsion to break and the fat, oil or wax rises to the surface. Some of the coloring matter stays in the water and dirt and other insoluble matter settles out on standing. Then the upper layer of fat, oil or wax is drawn off and is found to be lighter in color, free from dirt and insoluble matter and often improved in odor.

Formula #8 is used in hair treatments in place of olive oil as it penetrates better and is washed out more readily. Formulae #14 and 18 are similarly used in cosmetics.

In chemical reactions where contact between a watery solution and a water insoluble material is desired resort is had to emulsification. In this way the two media are subdivided into minute particles having an extremely large surface area with the result that the reaction proceeds more rapidly and completely. For example, if we try to hydrolyze ethylene dichloride with an aqueous solution of caustic soda we see that the two liquid phases are immiscible. If, however, the ethylene dichloride is emulsified and then treated with an aqueous solution of caustic soda, under suitable conditions, hydrolysis soon starts. These emulsions for promoting synthetic reactions should be agitated violently especially in those cases where acids or salts are present. A recent adaptation of this principle concerns itself with the hydrogenation of oils. By emulsifying the oil, infinitely larger surface is exposed to the attack of the hydrogen with a resultant increase in speed and completeness of hydrogenation.

In the paint, varnish and printing ink industries various "driers" are in continual use to speed up the drying of the oil vehicle. Metallic linoleates are in great favor in many directions. Their lack of uniformity and dark color has prevented their more universal use. They can now be made absolutely uniform and of a lighter color by adding a hot solution of a metallic salt (while stirring vigorously) to a hot solution of ammonium linoleate.

In conclusion it is hoped that the above definite exemplifications of utilitarian applications of emulsion phenomena will serve as a starting point to those technicians who are continually on the look-out for improvements in process; production of novel products; or lowering of costs and fire-hazards.

Oil of Sumac

By H. P. TREVITHICK

SUMAC berries are very plentiful in the United States, particularly along the Atlantic seaboard. They are used particularly as a source for tannin, in textile dyeing and in medicine.

On extraction with petroleum ether, they yield a dark, greenish brown colored, rather viscous oil. The total oil content was 17.54%.

This oil had the following characteristics:

Moisture & Volatile Matter @ 105° C.	0.18%
Specific Gravity @ 15.5° C.	0.9256
Iodine Value (Wijs)	96.1
Saponification Value	183.2
Free Fatty Acids (Oleic)	10.7%
Acid Value	21.4
Unsaponifiable Matter (petroleum ether extract)	2.38%
Index of Refraction @ 25° C.	1.4726
Index of Refraction @ 20° C.	1.4744
Total Fatty Acids & Unsaponifiable	95.1%
Iodine Value of the Fatty Acids	96.7
Neutralization Value of Fatty Acids	193.2
Mean Molecular Weight	296.9
Titre	25.7° C

These values are quite different from those given by *Lewkowitsch*, (See Volume II, of the VI Edition, page 246).

The hardening of stearolic ethyl ester under hydrogenation is said to occur in steps, the triple bond being reduced to a double bond before any stearic acid begins to form. Harrie's ozonation method shows the absence of any shifting of the triple bond during hydrogenation. *Chem. Umschau Fette, Oele, Wachse u. Harze* 38,23-4 (1931).

Brazilian Lard Trade in Rio Grande do Sul*

Large and Growing Business Devoted Chiefly to Brazilian Trade, Small Quantities Only Being Exported

ACCORDING to figures made public by the Delegacia do Servicio de Industria Pattoril, there were 112,962 hogs slaughtered in 1930, by the principal slaughter houses in the State of Rio Grande do Sul which are registered at the Brazilian Ministry of Agriculture. In addition to this a great number of hogs were slaughtered by farmers in the interior of the State, who sold the crude lard to the lard refineries. It will be noted that the total number of hogs in Rio Grande do Sul, reported as of December 31, 1929, was 5,933,140.

Production of Lard

THE production of lard by the lard refineries amounted to 173,734,361 pounds in the year 1930, which represented an increase of 14,260,761 pounds over the production of 1929. The total exports of lard from the State in 1930 amounted to 70,465,487 pounds valued at more than $6,842,105. This quantity includes also stocks carried over from 1929 and which were consumed chiefly in the State of Rio Grande do Sul.

The foreign exports of refined lard in 1930 amounted to 842,450 pounds, it will thus be seen that the largest bulk, amounting to 32,623,037 pounds was sold in local and other Brazilian markets. In 1929 the foreign exports of lard amounted to 792,000 pounds and exports to domestic markets amounted to 91,476,000 pounds, making a total exportation of 91,555,200 pounds.

The Sociedade de Banha Rie Grandense, Ltda, (Lard Society of Rio Grande do Sul) has just concluded the construction of a modern slaughter house with adjacent departments for lard refining, a refrigerating and pork meat packing plant.

The establishment is located in the municipal district of Santo Angelo and occupies an area of 40,371 square meters including a ranch containing 1,300 hogs at a time. American methods will be adopted for the refining and refrigerating of lard, and for this reason all machinery for these purposes was imported from the United States.

There are twenty tanks, each having a capacity of 5,000 kilos, thus making it possible to collect 100,000 kilos (220,000 pounds) at a time. It is equipped with three clarifiers, with a total capacity of 26,400 pounds. The refrigerating chamber is equipped with a compressor which will produce 40 tons of ice, and is said to be equipped so as to prepare 70,400 pounds of refined lard in an eight hour day. The plant will start to work with a daily output of 600 boxes, or 79,900 pounds of refined lard per day. (Note—Each box contains three tin cans, each containing 44 pounds of lard net weight.)

Meat Packing Division

ONE of the principal features of this new plant is the industrializing of pork meat and other by-products for the foreign export trade. In this connection a special department has been inaugurated which will prepare pork meat in accordance with the style in demand in British markets, and which is known as "corned pork." Tongues will also be prepared and canned for the foreign export trade. Pork meat, or corned pork will be packed in cans of 1 and 6 pounds each and will be sold in British markets exclusively.

Other Lard Refineries

OTHER lard refineries which are either owned or controlled by the Lard Syndicate of Rio Grande do Sul, are located in the following municipal districts: Porto Alegre, 1; Taquara, 1; Nova Petropolis, 1; Sao Sebastiao do Cahy, 1; Caxias, 1; Monte Veneto, 1; Guapore, 1; Dois Lageados, 1; Barra do Guapore, 1; Lageado, 1; Eastrlla, 1; Bom Retiro, 1; Ijuhy, 1; Carasinho, 1; Passo Fundo, 1; Erechim, 1; Boa Vista do Erechim, 1; Viaductos, 1.

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* *Based on Report of U. S. Consul Nasmith (Porto Alegre) to Bureau of Foreign and Domestic Commerce, Foodstuffs Division.*

Anti-oxidants in Edible Oil Preservation*

Resistance to Oxidation Attributable to Presence of Minute Quantities of Added or Natural Inhibitory Catalysts

By F. C. VIBRANS

PROBABLY our first experience with a catalyst dates back to the time when we studied general chemistry. We were instructed to make oxygen from potassium chlorate and manganese dioxide. The manganese dioxide acted as a catalyst which aided the reaction causing the oxygen to be liberated from the potassium chlorate at a lower temperature, and at the same time did not enter into the reaction. With this introduction to a catalyst and a catalytic reaction, as time passed, other catalysts became familiar to us as did a great many reactions in which catalysts play an important role.

In recent years another type of catalyst has attracted our attention, namely, negative catalysts, and more specifically, anti-oxidative catalysts. This type of catalyst is not, as the name implies, one that will cause a reaction to go in a direction opposite to its natural tendency, but it is one that either slows up or completely stops a reaction which would otherwise take place. It is in this type of catalyst that we are now interested.

Although anti-catalysts have attracted attention only in recent years, they have been known for a long time. Berthollet[1], in 1797, observed that traces of the vapors of sulfur compounds prevented the luminescence of phosphorous in a dilute atmosphere of oxygen. Davey[2], in 1817, and others have shown that the detonation of an explosive mixture of hydrogen and oxygen, or the slow combustion of hydrogen under the influence of platinum is prevented by the presence of relatively small amounts of certain gases such as ethylene and carbon monoxide. Deschamps[3], in 1843, showed that fresh lard containing gum benzoin or populin did not become rancid as soon as did pure lard when held under ordinary conditions. Frankland[4], in 1862, observed that ethylene diminished the inflammability of carbon disulfide vapor. Rump[5], in 1868, was the first to report that small amounts of alcohol prevented the oxidation of chloroform by atmospheric oxygen. This observation has served as the basis of a practical method for the stabilization of anesthetic chloroform and has resulted in lessening the danger of using chloroform in surgical operations.

Bigelow[6], in 1898, first observed that solutions of sodium sulfite when exposed to the air were stabilized by the addition of benzyl alcohol, benzaldehyde, butyl alcohol, glycerine, mannite, cresols, etc. In 1909, Welborn[7], stated that the incorporation of sufficient oil of pimento with lard to make the odor slightly perceptible prevents the development of rancidity and discoloration for two years under usual conditions. Siebeneck[8], in 1922, observed that traces of sulfur prevented the oxidation of paraffin in free oxygen up to a temperature of 135° C.

Moureu and Dufraisse have worked extensively on anti-oxygenic reactions. Their first publication appeared in 1922 and since that time many articles have been published by them on a great variety of auto-oxygenic reactions and theories to explain these reactions. Their first work had to do with the stabilization of acrolein. This was a war problem and was solved by adding small amounts of phenolic compounds to the acrolein. Since then, they have actually tested hundreds of anti-oxidants, or anti-oxygens as they prefer to call these anti-catalysts, by adding them to oxidizable substances and measuring the effect produced. A partial list of the anti-catalysts they tested include phenol, catechol, pyrogallol, naphthals, tannins, iodine, inorganic iodides, ammonium iodide and substituted ammonium iodides, organic iodine compounds, iodoform, carbon tetraiodide, sulfur, phosphorus sesquisulfide, inorganic sulfides, thioethers, mercaptans, ali-

*Presented at Fall Meeting American Oil Chemists' Society, Chicago, November 14, 1930.

phatic and aromatic amines, nitrites, amides, ureas, urethanes, substituted hydroxylamines, dyes, etc. These substances were used in preserving such compounds as sodium sulfite, acetaldehyde and heptaldehyde, acrolein, chloral, benzaldehyde, furfural, styrol, phenylbromoethylene, diphenylethylene, essence of turpentine, complex organic substances such as rubber, fats and oils.

Theories of Anti-oxidant

HAVING directed attention to some of the earlier observations on auto-oxidative reactions and enumerated some of the compounds that have been used for anti-oxidants and some of the oxidizable substances that have been protected by these anti-oxidants, let us now consider some of the theories that have been advanced to explain these facts.

Titoff[9], in 1903, suggested that the presence of traces of appropriate impurities is necessary and sufficient to permit auto-oxidation. Assuming this, then it should be comparatively simple, by the addition of a small amount of material that will destroy the oxidative impurities, to stabilize the system. It is in this way that Titoff explained the hindering effect caused by traces of benzyl alcohol, benzaldehyde, mannite, glycerin and various phenols in the auto-oxidation of dilute solutions of sodium sulfite. It is evident that this theory is not sufficient to explain all auto-oxidative reactions because it is not logical to believe that all auto-oxidative reactions are caused by impurities.

Alyea and Bäckström[10], in 1929, presented the so-called chain theory to explain the inhibitory effects of certain alcohols, as secondary butyl, benzyl, and isopropyl alcohols, on the auto-oxidation of solutions of sodium sulfite. They presented both thermal and photochemical data, and it is on these data that they base their chain theory of auto-oxidation. This theory assumes that a molecule of the oxidizable substance (sodium sulfite) becomes activated by absorbing a unit of energy from light or any other available source and in this active state reacts with oxygen. The oxidation reaction liberates heat energy which activates one or more sodium sulfite molecules. These activated molecules then react with oxygen to produce an oxidized compound and more heat. The heat liberated activates more sodium sulfite molecules, etc. If an anti-oxidant is present, it breaks up these chain reactions by taking up the liberated energy and becoming activated and oxidized itself. Thus by stopping the chain reaction the catalyst is destroyed. Thus Alyea and Bäckström explain the observation that a small amount of anti-oxidant will not protect an oxidizable substance forever. They give experimental data to prove that the rate of anti-oxidant destruction is in agreement with their theory. The only discrepancy between their data and their theory lies in the fact that their data account for the destruction of two molecules of anti-oxidant where their theory calls for the destruction of one molecule only of anti-oxidant. This, however, does not seriously affect their theory as they present it.

Before reviewing the theory advanced by Moureu and Dufraisse[11], I want to call your attention to some general observations they have made on auto-oxidation reactions. They have experimented with more than three hundred anti-oxygens and report that "not a single anti-oxygen was found that is not capable of oxidation, and the activity of the anti-oxygen is located in the oxidizable portion of the molecule. The catalytic activity of an anti-oxygen should increase with increase of oxidizability. Every oxidizable substance should be able to act as an anti-oxygen under favorable conditions. This property would be a general one associated with all oxidizable substances. The favorable conditions would vary according to the nature of the substances. In the case of any two auto-oxidizable substances that are placed in contact with each other, it should be possible to find conditions under which one may play the role of an anti-oxygen towards the other." They further state that "auto-oxidation is very often accompanied by secondary reactions such as molecular condensation which is manifested by resinification, or the development of colorations, precipitates or rancidity. When an anti-oxygen prevents the fixation of oxygen we observe a simultaneous inhibition of these secondary reactions."

There is no general rule that can be applied to anti-oxygens because the substances which may act as anti-catalysts for some compounds are pro-catalysts for other compounds. For example, Moureu and Dufraisse[11] state that "iodine, a powerful anti-oxygen towards benzaldehyde, is a pro-oxygen towards styrol. Iodoform, which is a pro-oxygen towards styrol, is an anti-oxygen towards furfural. Phosphorus sesquisulfide (P_4S_3) which is an anti-oxygen towards benzaldehyde is a pro-oxygen towards linseed oil. Thiophene is an anti-oxygen towards benzaldehyle and a pro-oxygen towards turpentine."

Moureu and Dufraisse

TAKING up the theories advanced by Moureu and Dufraisse[11], I cannot do better than give you their own explanation. If we "consider anti-oxygenic action as a catalytic reaction, it is essential to conclude that the

phenomenon of auto-oxidation of a substance (A) does not consist in a continual drop of potential of the system $A + O_2$ until oxidation is complete. We must assume an increase of potential at a certain moment.

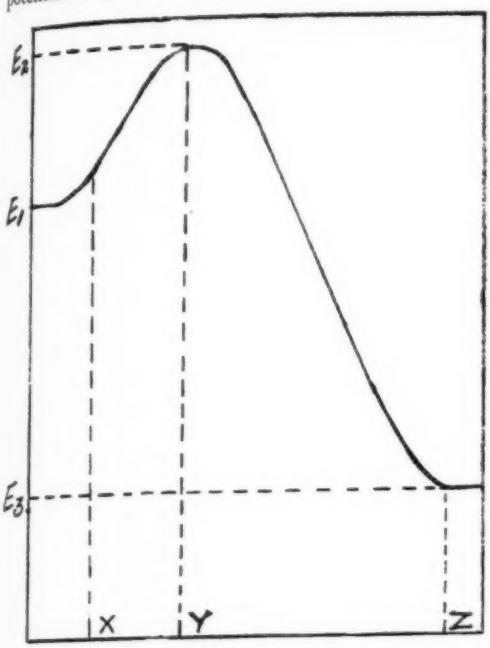


Fig. 1.

"The above curve is a graphical representation in which time is the abscissa and the ordinate is the potential energy of the mixture of the two molecules A and O_2 which are to react with each other. It is in the portion of the curve projected in XY that anti-oxygenic action occurs. This conception was not invented by us for the needs of the moment. It is a relatively old notion of Arrhenius, which is coming to play an increasingly important part from day to day in our modern physical theories.

"It is well known that physical and chemical observations have led to the inference that in a fluid (gas or liquid) made up of a definite chemical species, all the molecules are not in the same state. From the standpoint of energetics, the states of the individual molecules are distributed around a mean state and the proportion of molecules in a given state varies inversely with the difference from the mean state. Molecules removed from the mean state are called activated. In most chemical reactions all of the molecules present cannot interact simultaneously, and at a given moment only a small portion of the entire number can enter into reaction. The velocity of a reaction is regulated by the proportion of active molecules, and by the speed with which they are formed in the mass. Due to developments of this theory by a number of investigators including Berthoud, Morcelin, Lewis, Perrin Langevin and others, one may calculate the excess of energy which must be acquired by the molecules in a mean state to become activated for a given reaction. This minimum additional energy requirement is called the critical increment of energy. The energy which activates molecules is acquired at the expense of the average energy of the system."

Referring again to the chart "average molecules are found on the E_1 level. Those which react must pass through the level E_2 before descending to the level E_3 which represents the state of auto-oxidation. As it passes through E_2 two catalyses are possible, both positive, of which the results are diametrically opposite, one favoring movement to E_3, the other anti-oxygenic favoring the return to E_1. Thus if all the molecules at E_2 were caused to go back to E_1 the entire phenomenon of anti-oxidation would be suppressed. This explains why a few molecules of the anti-oxygen can protect many molecules from oxidation. For example, 1 mol. of hydroquinone protects 40,000 mols. of acrolein, and even in much greater dilution a strong inhibiting effect is noticed."

"The addition of a substance which would lessen the number of active molecules would slow up the reaction and should also catalyze the return of the active molecules to the mean level. In order to explain how one molecule of hydroquinone will protect 40,000 molecules of acrolein from oxidation we have to assume selective attraction of the anti-oxygen for at least one of the active members of the reaction mixture (either active molecules of oxygen, or of the auto-oxidizable substance, or of the first product of their union). We must further assume that as soon as one of the molecules is available to react that the auto-oxygen reacts with it immediately and surely. The anti-oxygen must not hesitate between an active and an inactive molecule. If it were to do this, its value as an anti-oxygen would be of no value because of the great number of "inactive molecules surrounding it."

With these considerations before you, let us now apply them to a general anti-oxygenic reaction. Auto-oxidation, according to Moureu and Dufraisse[11], starts with the union of an oxygen molecule O_2 with an activated molecule of the oxidizable substance (A) forming a peroxide $A(O_2)$ which they call a primary peroxide. The resulting molecule $A(O_2)$ is active and is at the position E_2 on the diagram. The anti-oxygen will catalyze this reaction

back in the direction from which it came to its destruction. This reaction must be fast and complete.

Representing this with symbols we have:

$(A) + O_2 \rightarrow (AO_2)$
$(AO_2) + B \rightarrow (AO) + (BO)$
$(AO) + (BO) \rightarrow A + B + O_2$
called negative catalysis.

or

$(A) + O_2 \rightarrow (AO_2)$
$(B) + O_2 \rightarrow (BO_2)$
$(AO_2) + (BO_2) \rightarrow A + B + O_2$
called negative catalysis.

The substances (AO) and (BO) and also $(AO_2) + (BO_2)$ are antagonistic and mutually destroy each other. This type of reaction is not imaginary because there are several illustrations which might be given, as $KMnO_4$ and H_2O_2.

If the above reaction does not take place quickly enough another reaction is then possible.

$(A) + O_2 \rightarrow (AO_2)$
$(AO_2) + B \rightarrow (AO) + (BO) +$
$A + B + (AO)\ AO$
called positive, stable catalysis.

Moureu and Dufraisse have applied these type reactions to a great variety of auto-oxidation reactions and have found none where they could not make their theory explain the facts as they observed them.

With the general theories before you to explain auto-oxidative reactions, their application to the oxidation of fats and oils, with the development of rancidity, becomes of interest.

Numerous investigators, Harris[12], Scala[13], Canzoneri and Bianchini[14], Langbein[15], Nicholet and Liddle[16], Salkowski[17], Stärkle[18], Browne[19], Watkev[20], Kerr and Sorber[21], and others studying the chemistry of rancidity of fats and oils have isolated and adequately identified a variety of cleavage products. These include formic acid, acetic acid, butyric acid, (C_3H_7COOH), caproic acid ($C_5H_{11}COOH$), heptylic acid ($C_6H_{13}COOH$), caprylic acid ($C_7H_{15}COOH$), nonylic or petrogonic acid ($C_8H_{71}COOH$), capric acid ($C_9H_{19}COOH$), and azelaic acid ($HOOC(CH_2)_7COOH$). Many of the aldehydes of these acids have also been identified. Likewise, hydroxystearic, and palmitic acids have been identified, and there is evidence to show the formation of polymerized bodies. Along with these compounds hydrogen peroxide is mentioned by many of the investigators in this field. Undoubtedly the oxidation products of unsaturated fatty acids will depend upon the position and number of the double bonds and whether there is a shifting of these bonds during oxidation.

Research of Powick

POWICK[22], in 1923, reports on an extended piece of research in which he set out to find the compound or compounds that are responsible for the rancid odor in oxidated fats and oils. He also sought to find the compound or compounds that give the Kreis test. Powick's original plan was to prepare a considerable quantity of oleic acid of unquestionable purity, and after it had become intensely rancid, to examine it qualitatively for the products formed. The preparation of pure oleic acid was found to be impracticable and a preliminary attempt at the fractionation of rancid oleic acid indicated that the analytical method would be accompanied by many difficulties, so the plan was abandoned and in its place was substituted a systematic search among the known degradation products of oleic acid for the substance or substances with the characteristic rancid fat odor.

(*To be continued*)

Determination of Unsaturation

The Wijs method for determination of iodine number shows the theoretically true unsaturation value when correct experimental conditions are selected, except with triple bonds, which become only one-half saturated by halogens. There is no substitution by iodine even in prolonged action of the reagent. For official analyses the iodine number of the acids (after removal of the unsaponifiable matter) should be determined in addition to that of the oil, because their iodine number is more constant than that of the oil. If the total acids show an iodine number which increases on continued action of the reagent, a polymerized product or some unknown acid may be present. *Chem. Umschau.* 37,257-62.

Another method of estimating the total unsaturated fatty acids of higher unsaturation than oleic is based upon the conversion of unsaturated fatty acids of high molecular weight into ether acids. The saponified fat carrying 0.1% excess alkali is polymerized in an atmosphere of hydrogen for two to three hours at a temperature of 290°C. This procedure reduces the unsaturation of those fatty acids containing more than one double bond to that of oleic acid. The difference in iodine numbers of the separated fatty acids before and after polymerization is a measure of the fatty acids containing more than one double bond.

Fat and Oil Data for First Quarter 1931

Production, Consumption, Exports and Imports with Factory and Warehouse Stocks March 31, 1931

WASHINGTON, D. C., May 6, 1931.—The Department of Commerce announces that the factory production of fats and oils (exclusive of refined oil and derivatives) during the three-month period ended March 31, 1931, was as follows: vegetable oils, 675,868,188 pounds; fish oils, 11,586,728 pounds; animal fats, 618,458,848 pounds; and greases, 95,948,191 pounds; a total of 1,401,861,955 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 488,868,745 pounds appears for lard. Next in order is cottonseed oil with 395,406,614 pounds; tallow with 128,367,352 pounds; linseed oil with 118,417,218 pounds; coconut oil with 91,445,505 pounds, and corn oil with 28,652,287 pounds, follow in order.

The production of refined oils during the period was as follows: Cottonseed, 396,855,042 pounds; coconut, 66,268,268 pounds; peanut, 4,089,847 pounds; corn, 26,129,525 pounds; soya-bean, 2,108,114 pounds; and palm-kernel, 5,542,826 pounds. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statement:

PRODUCTION, CONSUMPTION, AND STOCKS OF FATS AND OILS

(In some cases, where products were made by a continuous process, the intermediate products were not reported.)

KIND	Factory operations for the quarter ended March 31, 1931		Factory and Ware'se stocks March 31, 1931
	Production (pounds)	Consumption (pounds)	(pounds)
VEGETABLE OILS: [1]			
Cottonseed, crude	395,406,614	436,875,300	69,878,003
Cottonseed, refined	396,855,042	276,905,542	494,503,313
Peanut, virgin and crude	5,214,362	4,806,717	881,779
Peanut, refined	4,089,847	3,072,400	5,694,432
Coconut, or copra, crude	91,445,505	138,254,541	201,932,237
Coconut, or copra, refined	66,268,268	75,479,461	16,868,934
Corn, crude	28,652,287	30,407,253	8,119,460
Corn, refined	26,129,525	8,898,894	9,632,897
Soya-bean, crude	9,086,115	4,528,575	16,653,981
Soya-bean, refined	2,108,114	2,138,775	3,427,713
Olive, edible	1,509,164	204,597	6,045,045
Olive, inedible	5,250	1,830,746	1,446,034
Sulphur oil, or olive foots	—	10,088,579	21,270,221
Palm-kernel, crude	1,885,585	13,536,889	15,251,064
Palm-kernel, refined	5,542,826	6,022,736	1,539,048
Rapeseed	—	2,389,819	5,309,782
Linseed	118,417,218	74,091,829	113,191,578
Chinese wood or tung	—	22,765,025	45,432,947
Chinese vegetable tallow	—	878,742	2,591,022
Castor	12,212,958	4,489,677	6,633,863
Palm	—	74,432,367	84,837,129
Sesame	11,462,770	8,122,042	6,334,858
All other	570,360	957,879	5,002,525
FISH OILS: [1]			
Cod and cod-liver	120,698	3,772,539	9,018,911
Menhaden	—	4,383,823	6,696,295
Whale	—	16,404,587	85,295,030
Herring, including sardine	11,295,690	17,087,485	103,790,633
Sperm	—	268,838	3,102,536
All other, (including marine animal)	170,340	2,702,568	7,501,902

[1] The data of oils produced, consumed, and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries.

PRODUCTION, CONSUMPTION, AND STOCKS OF FATS AND OILS (Continued)

KIND	Factory operations for the quarter ended March 31, 1931 Production (pounds)	Consumption (pounds)	Factory and Ware'se stocks March 31, 1931 (pounds)
ANIMAL FATS:			
Lard, neutral	7,014,297	2,192,168	3,005,239
Lard, other edible	481,854,448	3,389,432	70,338,642
Tallow, edible	12,467,939	12,153,934	4,698,792
Tallow, inedible	115,899,413	135,680,930	145,040,349
Neat's-foot oil	1,222,751	1,534,047	1,315,239
GREASES:			
White	20,754,536	11,516,130	10,743,906
Yellow	22,269,093	10,582,558	12,484,972
Brown	12,039,206	12,436,278	11,087,963
Bone	5,596,256	96,973	4,067,886
Tankage	11,888,511	82,055	6,136,884
Garbage or house	17,939,997	16,103,251	23,500,943
Wool	2,069,359	1,012,301	3,669,472
Recovered	727,393	428,306	4,195,808
All other	2,663,840	1,088,525	3,124,339
OTHER PRODUCTS:			
Lard compounds and other lard substitutes	291,385,942	349,427	26,081,027
Hydrogenated oils	149,582,329	137,823,169	21,902,476
Stearin, vegetable	3,228,562	3,913,704	1,867,022
Stearin, animal, edible	11,616,249	8,535,900	3,253,716
Stearin, animal, inedible	3,864,363	3,964,691	7,579,068
Oleo oil	22,053,196	8,487,492	14,004,300
Lard oil	6,493,082	2,732,814	4,315,032
Tallow oil	2,041,457	1,763,803	1,983,673
Fatty acids	31,090,974	32,866,048	10,380,620
Fatty acids, distilled	14,347,506	10,204,244	5,414,458
Red oil	9,139,631	6,345,562	5,171,197
Stearic acid	6,326,064	1,826,119	4,804,290
Glycerin, crude 80% basis	35,187,818	36,311,437	13,561,891
Glycerin, dynamite	10,351,595	4,257,766	11,878,350
Glycerin, chemically pure	18,306,203	2,327,315	9,027,575
Cottonseed foots, 50% basis	68,284,251	52,373,101	85,635,468
Cottonseed foots, distilled	20,861,139	20,340,228	7,435,843
Other vegetable oil foots	12,572,077	12,647,994	2,926,687
Other vegetable oil foots, distilled	495,419	723,498	1,378,155
Acidulated soap stock	12,286,956	12,758,934	26,567,993
Miscellaneous soap stock	574,267	1,124,420	1,632,906

RAW MATERIALS USED IN THE MANUFACTURE OF VEGETABLE OILS

KIND	Tons of 2,000 pounds Consumed Jan. 1 to Mar. 31	On hand Mar. 31	KIND	Tons of 2,000 pounds Consumed Jan. 1 to Mar. 31	On hand Mar. 31
Cottonseed	1,272,284	206,926	Flaxseed	183,980	65,661
Peanuts, huled	6,219	1,970	Castor beans	13,338	3,845
Peanuts, in the hull	2,641	449	Sesame seed	12,113	3,954
Copra	71,229	27,167	Soya-beans	32,315	34,549
Coconuts and skins	609	26	Olives	4,661	—
Corn germs	54,612	171	Other kinds	3,240	1,533

IMPORTS OF OIL SEEDS, QUARTER ENDED MARCH 31, 1931

KIND	Tons	KIND	Tons
Castor beans	5,661	Poppy seed	1,260
Copra	59,485	Perilla and sesame seed	18,003
Flaxseed	73,268	Other oil seeds	3,195

IMPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED MARCH 31, 1931

KIND	Pounds	KIND	Pounds
Animal oils & fats, edible	536,244	Sulphur oil or olive foots	6,008,644
Whale oil	51,044,310	Other olive oil, inedible	2,956,843
Cod oil	2,792,820	Palm oil	74,592,232
Cod-liver oil	3,007,305	Palm-kernel oil	4,862,288
Other fish oils	2,857,658	Sesame oil	—
Tallow	108,805	Carnauba wax	2,670,312
Wool grease	1,115,475	Other vegetable wax	511,114
Stearic acid	1,128,048	Rape (colza) oil	2,917,673
Grease and oils, n.e.s. (value)	$20,425	Linseed oil	91,672
Olive oil, edible	12,985,333	Soya-bean oil	1,453,583
Peanut oil	536,951	Perilla oil	2,381,843
Other edible vegetable oils	8,304,005	Other expressed oils	513,512
Tung oil	17,408,897	Glycerin crude	2,914,104
Coconut oil	96,273,974	Glycerin, refined	485,204

EXPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED MARCH 31, 1931

KIND	Pounds	KIND	Pounds
Animal fats & oils, edible	1,873	Coconut oil	304,385
Fish oils	35,194	Palm & palm-kernel oil	375,853
Other animal oils & fats, inedible	9,506	Peanut oil	6,574,406
Olive oil, edible	26,278	Soya-bean oil	60,266
Tung oil	1,278,524	Other expressed oils & fats	1,552,279
		Vegetable wax	183,309

(*Turn to Page 237*)

ABSTRACTS

David Wesson, *Abstract Editor*

The unsaponifiable volatile matter produced during the hydrogenation of fish oils is said to contain iso-aliphatic C_9, C_{10} and C_{13} primary alcohols of the saturated and olefine series together with hydrocarbons of the iso-paraffin and olefin series. *J. Soc. Chem. Ind. Japan,* 34, Suppl. Bind. 35-7 (1931).

Decrease in speed in the progressive hydrogenation of oils is said not to be due to the catalyst, since that can be reused several times, nor to the concentration in the oil of ethylenic linkages, since linseed and fish oils are hardened less rapidly than cottonseed oil; but is due, it is claimed, to the increasing concentration of saturated acids and the manner of hydrogenating. By determining the insoluble bromides formed by highly unsaturated acids, at the different stages of fish-oil hardening, the fact was confirmed that clupanodonic acid can be reduced completely to less unsaturated acid, without forming stearin, by means of gentle hydrogenation, under the influence of reduced temperatures, less agitation and smaller amount of catalyst. *Z. Angew. Chem.* 44, 184-7, *Chem. Abstr.* 25,2582 (1931).

In experiments on the progress of catalytically induced rancidity in oleic acid and oleic ethyl ester, hydroquinone reacted throughout as a strong negative catalyst. Ferric chloride acted as a strong positive catalyst, as judged by the Kreis test, while ferrous oleate appeared to be a negative catalyst. *Z. angew. Chem.* 43, 1108-12; *Chem. Abstr.* 25, 1693 (1931).

Carbon dioxide gas or steam may be passed through hydrogenation converters before removal of the catalyst. Either has been found quite satisfactory for the purpose, according to experimenters in Russia. *Maslob. Zhir. Delo* No. 5, 23-4.

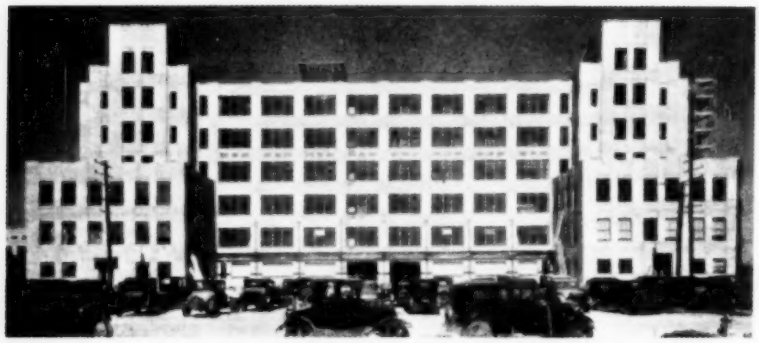
Those support materials which inhibit the catalytic activity of platinum and palladium have been found to affect nickel similarly. The behaviour of supports with relation to the hydrogenation of cottonseed oil with nickel catalyst may be classified as follows: reducible heavy metal oxides completely inhibit the activity of the nickel; the salts of those metals that decompose upon heating in a stream of hydrogen completely inhibit activity; substances with corrosive properties retard but do not completely inhibit activity. The salts in every case have been found to yield more active supports than the corresponding oxides. The more inert the support becomes toward nickel, the greater is the tendency to enhance activity, and the less inert the support the greater its tendency to retard activity. *Trans. Elektrochem. Soc.* 59, preprint (1931).

It is suggested that yield differences in the oil mill between the calculated yield based upon laboratory analyses and the actual factory yield (about 1%) may be due to phosphatides or lipoids showing different solubilities under laboratory and factory conditions. *Chem. Umschau Fette, Oele, Wachse u. Harze* 38, 33-4 (1931).

A suggested modification of Dopfer's method for the determination of fat in oil seeds is as follows: place 4 grams of the ground seed in a round-bottom, heavy glass bottle together with 40 cc. of gasoline (b.p. 40-60° C.), 10-12 grams of sand and 5-6 steel balls of 10-12 mm. diameter and grind in a shaking machine for one to two hours or until apparently dust-free; allow to settle, evaporate twenty cc. of the gasoline extract, weigh and calculate the percent of fat according to the formula: $x=(100 \times 40 \times f)/4(20-1.0753f)$ in which f is the weight of the oil residue from 20 cc. gasoline solution and 1.0753 is the specific gravity factor for the oil (1.00/0.93). *Chem.-Ztg.* 55,70 (1931).

The real cause of the temperature increase in the Mackey test is said to be rapid oxidation of the linolic or linolenic acid when present in the olein tested. This temperature increase is accelerated by iron soaps or other positive catalysts and is inhibited by negative catalysts such as beta-naphthol. *Seifensieder-Ztg.* 58, 29-32 (1931).

Notes of the Industry



Edible Products Building
Procter & Gamble Co.
Long Beach, Cal.

Procter California Plant

The edible section of the new Procter and Gamble plant at Long Beach, California, shown above, is expected to be in operation in the latter part of this month. The Long Beach plant includes complete equipment for the manufacture of soap, as well as the company's various edible products and will, it is expected, effect marked savings in production costs and freight on the growing volume of business in Procter and Gamble products on the Pacific Coast.

Shortening Sales Distribution

Manufacturers of shortening and vegetable cooking oils dispose of output principally to their own branches, more than three-fourths of the production being sold in this manner. Data collected by the U. S. Census Bureau shows that of the total sales of these products in 1929, amounting to $152,842,000, 79.8 per cent, or $120,687,000, was sold to manufacturers' own wholesale branches for distribution to wholesale and retail dealers and users.

Sales of the remainder 20.2 per cent, were through the following channels: To wholesale dealers, 13.6 per cent, or $20,799,000; to retail dealers, 1.4 per cent, or $2,089,000; to users, such as manufacturers of food, paint, soap, etc., 6.1 per cent, or $9,287,000.

Of the above sales $7,981,000 worth were made through manufacturers' agents selling agents, brokers or commission houses, exclusive of sales made in this way by manufacturers' own sales branches. Fifteen of the manufacturing plants in this industry sold through such agencies.

Lever to Enter U. S. Edible Trade

Lever Brothers Co., Cambridge, Mass., will, according to an announcement made in London by F. D'Arcy Cooper, chairman of the board of Lever Brothers, Ltd., and joint chairman of Unilever, Ltd., enter the edible fat and oil trade in the United States. It is judged that this means the manufacture of nut butters, margarin, shortening and allied lines. Mr. Cooper stated that the United States and Canada offer an enormous field for edible fatty products, and in connection with the large manufacturing and distributing organization of Lever in both Canada and the States, the Lever board believes that full advantage should be taken of the opportunity in the North American markets.

The location of the American Lever edible products plant will be at Edgewater, N. J., where a plant belonging to the American Can Co. has been leased for a long period of years. The plant has been unoccupied since the war and no date has been set for opening it by Lever, pending the installation of new equipment. It is stated that about one thousand persons will be employed when operations get under way.

It is estimated that earnings of Procter & Gamble Co. for the year ending June 30, 1931, will total $24,000,000. Earnings in the previous fiscal year amounted to $22,450,000.

Stocks of crude cottonseed oil on hand in United States March 31, 1931, totaled 69,878,003 lbs., as against 103,372,027 at the same time last year. Stocks of refined oil held

March 31, 1931, totaled 494,503,313 lbs., compared to 536,097,214 lbs. held March 31, 1930.

Ross and Rowe Inc., announce the removal of their offices to 80 Broad Street, the Maritime Exchange Building, New York City.

Emery Industries, Inc., have announced a new form of stearic acid in the form of small flakes. The product is being shown for the first time at the Chemical Exposition this year. The flakes are pure white triple pressed stearic acid.

Edward Wesson, son of David Wesson, of the Wesson Oil & Snowdrift Co., New York, suffered a broken arm and severe bruises in a fall from the third story of the Wesson Montclair, N. J., home. He is recovering at Mountainside Hospital, Montclair.

Leghorn Trading Co., New York, moved May 2 to new quarters in the Commerce building, 153 East 44th Street. The Leghorn concern imports olive oil and citrus oils from Italy.

Sidney P. Craven joined Welch, Holme & Clark Co., New York, on May 1, after eleven years as secretary of Edward Flash Co., vegetable oil brokers. While with the latter concern, he handled the Procter & Gamble and Colgate accounts, and was later made floor member of the company on the N. Y. Produce Exchange.

Profits of Lever Brothers' operations in the United States, Canada, South America and the Philippines for 1930 amounted to approximately $5,300,000 as compared with $4,900,000 for 1929, says a London report. During 1930, the company spent about $5,500,000 on its new factory at Hammond, Ind., and on extensions of its Cambridge, Mass., plant.

Material increases in the rates of duty on imports of animal anl vegetable oils and fats have been placed in effect by the Mexican government under the terms of a recent presidential decree.

Elgin Softener Co., Elgin, Ill., has published a new booklet on the conditioning of boiler water which is available to interested manufacturers. A number of illustrations show different kinds of scale and sludge, while the text outlines how difficulties from these causes can be eliminated.

Industrial Chemical Sales Co., New York, announces that Fred E. Stuart has resigned his position with the city of Daytona Beach, Fla., to represent Industrial in the sale of "Nuchar" activated carbon.

Members of the New York Oil Trades Association enjoyed a day of golf on May 12 when they met with the Philadelphia association at Travistock, Haddonfield, N. J., approximately midway between the two cities. The golfers left New York at 9:00 A.M., making the trip by bus. Luncheon and dinner were served at Travistock. The annual outing of the association will be held at Briarcliff, June 16.

Emery Corporation is to be formed by the Emery interests of Cincinnati to acquire the capital stock of Emery Industries, Twitchell Process Co. and Kontol Co. It will have 100,000 shares of no par common stock which will control assets estimated at $5,000,000. No additional financing is contemplated.

Robert W. Brewer, formerly of the sales staff of Tunley & Co., New York, has become associated with the Atlas Refining Co., Newark, N. J., manufacturers of soluble oils and textile specialties. He will cover the State of New Jersey for the company.

Thomas C. Law, Past President of the American Oil Chemists' Society, of Atlanta, has been elected Right Eminent Grand Commander of the Knights Templar of Georgia.

C. C. Littleton, vice-president and general manager of the Gainesville (Tex.) Cotton Oil Co., delivered an address at the Texas Cotton Ginners Convention in Dallas last month on "Co-operation Between Oil Mills and Ginners."

Insecticide Kills Weevil

The use of Dr. Loebel's spray insecticide has proven highly successful in the prevention and destruction of weevil in cottonseed meal stored in sacks and cake, and a large number of mills with carry-over stocks of meal this summer are planning to use this remedy to save their prod-

uct. The insecticide is made and sold exclusively by Huntington Laboratories, Inc., of Huntington, Indiana. The company supplies suitable electric sprayers for applying the insecticide. Two experts of the company have been assigned to the oil mill industry in the Southern states for the purpose of aiding millers in preserving their carry-over stocks of meal this summer.

Although one of the Commonwealths of the Union is known as the "Sunflower State," the United States imports most of its sunflower seed and most of its sunflower seed oil, according to information made available by the foodstuffs division of the Bureau of Foreign and Domestic Commerce, Department of Commerce. Practically all of the world's supply of sunflower seed, says the foodstuffs division, is grown in Russia, Ukraine and Rumania, in the vicinity of the Caspian and Black Seas, and from there finds its way to the various markets. American imports of sunflower seed during 1929, the latest year for which these figures are now available, amounted to 1,620,643 pounds, valued at $93,559. Imports of sunflower seed oil are grouped with some other vegetable oils, so that exact figures on this product are not definitely known.

The three press cotton mill at York, S. C., heretofore known as the Yorkville Cotton Oil Co., has been purchased by John T. Stevens and Fred C. Culvern of Kershaw, and J. N. Lipscomb of Gaffney, that state. The new owners have been operating the mill during the past year under a lease.

William M. Steele, for many years the vice-president and general manager of John F. Jelke Co. of Chicago, has become general sales manager in the department of margarine and other food products for Durkee Famous Foods, a subsidiary of the Glidden Co.

Reduced flaxseed acreage this year in Argentina, India, and the United States, influenced by decreased demands for linseed oil, is indicated by recent reports of the U. S. Department of Agriculture. It is estimated that the plantings in this country are about 15 per cent off.

The Southland Cotton Oil Co. has closed down its mill at Chandler, Okla., and transferred Manager Earl Shotwell and other officials to the company's plant at Oklahoma City. The Chandler mill has five presses, and was built about 1899. It is stated as being doubtful when, if ever, it will be re-operated, but it is not being dismantled.

Higher fatty acid peroxides and peroxy compounds, such as valeryl, caproyl, capryl, lauryl, palmityl, oleyl, stearyl, and ricinolyl peroxides and peracids, suitable for bleaching, for use in pharmaceutical preparations, for synthesis, as bactericides and in dentifrices, are prepared by treating higher fatty acid chlorides with a solution of an alkali metal peroxide preferably of a concentration not over 10 per cent. Br. Pat. No. 334,531.

Fat and Oil Data

(*From Page 232*)

EXPORTS OF DOMESTIC FATS AND OILS, QUARTER ENDED MARCH 31, 1931

KIND	Pounds	KIND	Pounds
Oleo oil	12,567,487	Cottonseed oil, crude	5,235,180
Oleo stock	1,299,658	Cottonseed oil, refined	5,699,097
Tallow	1,470,934	Coconut oil, crude	2,613,064
Lard	196,036,872	Coconut oil, refined	583,233
Lard, neutral	2,767,522	Corn oil	301,083
Lard compounds, containing animal fats	356,613	Soya-bean oil	953,863
Oleo stearin	1,521,724	Vegetable oil lard compounds	1,376,252
Neat's-foot oil	270,125	Other edible vegetable oils and fats	418,121
Other animal oils, inedible	216,513	Linseed oil	317,142
Fish oils	736,362	Other expressed oils and fats, inedible	3,540,587
Grease stearin	1,372,416	Vegetable soap stock	6,660,020
Oleic acid, or red oil	188,415	Glycerin	78,204
Stearic acid	128,293		
Other animal greases & fats	20,438,415		

OIL & FAT INDUSTRIES

The Editor's Page

Wanted: A Way Out

THE cottonseed oil milling industry is still seeking its Moses. Almost hopelessly entangled in the wilderness of hostile farmers, unsympathetic federal and state bureaus and legislators, it cries aloud for the manna of *practical* help and for guidance through the Red Sea of depression into the promised land of profits.

All sorts of panaceas for the difficulties of the mills are being prescribed. The latest suggested remedy is contained in a report of examiners of the Interstate Commerce Commission, recommending a revision of all cottonseed and cottonseed products freight rates and a limited form of milling-in-transit rate on cottonseed.

The proposal has resulted in an immediate division of the mills into two camps. The recommendation of the Commission's examiners appears intended to benefit the railroads primarily, but the larger terminal oil mills are favorable to its adoption, as it will permit them to compete on more favorable terms with seed buyers for the smaller mills in local territory. The latter class, naturally, are opposed to the proposition, even though, in its present form, no application of the transit rate to oil and linters is contemplated, seed in, and cake meal and hulls out of the mill being the commodities affected.

Another problem being discussed by the oil millers during this Summer vacation from mill operation is that of organization for trade association. Some members of the National Cottonseed Products Association favor the abandonment of all State Association activities, while others desire to continue the state groups, either as independent organizations or as divisions of the National body.

While all these weighty matters require discussion and adjustment, the mills stand idle, as usual in this between-crop season.

Yet there are quantities of copra, sesame seed, peanuts, soybeans, sunflower seeds, etc., if not actually in the country, still readily obtainable to keep the presses and expellers turning out oil. What a reduction of overhead and fixed charge unit costs would be achieved by every mill, large and small, if year-round operation should be provided for by operating on other oilseeds during the closed season for cottonseed.

A Whale of a Problem

THE storage tanks of Norway are overflowing with the surplus of last season's whale oil production. Practically all of the Norwegian whaling companies have agreed to suspend operations for a period of one year to enable the world demand to catch up to the supply of whale oil, and to endeavor, in the meantime, to market the huge surplus at prices which will at least pay the cost of production.

Whale oil, chiefly because of the efforts and discoveries of chemists in the field of hydrogenation, has again become a staple world commodity. Its utility is many times what it was in the old days of the New Bedford sailors, when it could be used only in lamps and for lubrication. Today, after suitable treatment and when blended properly with other fats, it is a satisfactory ingredient for soaps of the highest class. In Europe it is used extensively in margarine, and its use in such a way in this country has been approved recently by that deputy arbiter of the American margarine industry, the Bureau of Internal Revenue.

Refined and hydrogenated whale oil is a clean, wholesome, sweet fat, and it is to be sincerely hoped that the real overseers of the margarine industry, our National Congress, will not hastily pass another law reversing the decision of their deputy and holding that this product of the sea may not be used in our kitchens because it comes from the wrong variety of cattle.

The hydrogenated product will also make a most satisfactory shortening product, particularly when blended with other fats. If some of our large shortening manufacturers had not spent such huge sums in past years to advertise their products as purely vegetable, many of us would be cooking with whale oil today, whether or not we were aware of the fact.

Producers, refiners and consumers of oils and fats must recognize this new important factor in their field. Whale oil apparently has come to stay, and the best reports obtainable from the Antarctic indicate that the supply can be mainained at high levels for many years. Undoubtedly, in time the market will be stabilized so that other fatty oils will not be affected so keenly in price by the whale oil run as in the past year or two, but for the present all producers and refiners of other fats and oils must exert their best efforts to maintain their markets for their own commodities.

Light on Ancient Customs

RECENTLY we had occasion to discuss some features of soap manufacture in the presence of a gentleman of learning and culture, one who had no contact, however, with chemistry or engineering.

After we had considered some of the ingredients used in soapmaking, and their various characteristics, this gentleman inquired: "What is soap, anyway"? We explained briefly the simple chemical reaction involved in the production of the sodium salts of mixed fatty acids, and the incident was closed.

Since, however, we have paused more than once to consider how little distribution there has been of the most elemental knowledge of the chemistry of soap manufacture, and how little real progress in the study of that chemistry until ten or fifteen years ago at the earliest.

This deplorable condition was due, without doubt, to the belief of many soap chemists that they possessed secrets beyond the ken of their fellows. Of how little value such secrets generally are every chemical student today is aware.

The Soap Section of the American Oil Chemists' Society, which has been an organized unit of the society for only a little over two years, is conducting cooperative work on soap analysis and glycerine analysis, which, for the enthusiasm of the members participating and for value of method comparisons, surpasses anything of the sort which we have ever before encountered.

This is only one activity of the American Oil Chemists' Society, of which every soap chemist and oil chemist in the country should be a member.

New Cuban Regulations

A decree published recently, drawn up to cover standards of purity for foods and drugs offered for sale in Cuba cancels previous decree of September 4, 1926, in which decree no difference was made between goods for immediate consumption and those for use in industries.

Article 3. For the importation of edible oils which contain impurities, or of vegetable oils of more than 3% acidity, it will be necessary to present a special permit for each shipment, in which the importer sets forth, under oath, the fact that these products are imported for purification or refining in a duly established factory, the name and exact location of which shall be stated.

Article 4. Edible vegetable oils, as well as animal fats or other food products, imported for refining or for elaboration, transformation, or addition to other food products, may not be offered for sale as long as they retain the impurities or defects which may have made them unfit for sale, or as long as the refined, elaborated or manufactured product does not conform to the standards and requirements set up by the Sanitary Ordinances, or by Special Regulations.

Article 5. In the case of foodstuffs refined, modified or transformed in Cuba, it will be required that such products when offered for sale shall set forth on the label in Spanish not only the type of product, but the name and location of the plant in which it was made. Without such a label its sale may be prohibited and the sanitary permit withdrawn from the plant.

New Plant for Panama

A report from Consul Davis, at Panama, is to the effect that an American concern which recently secured a concession from the Panama government for the exploitation of the palm nut resources of that Republic, contemplates the erection in the near future of three buildings constituting the base of the operations in Panama City.

The Government of India's final forecast of the 1930-31 peanut crop, gives the area sown as 6,240,000 acres, with an estimated yield of 2,988,000 tons of nuts in shells. This is an increase of 9 per cent in area and 12 per cent in yield over the 1929-30 crop of 5,748,000 acres.

Some Aspects of Seed Grading*

Application of Chemical Methods to Control Purchase of Raw Material by Cottonseed Mills Presents Important Field for Chemists

By Andrew K. Schwartz

THE majority of those connected with the cottonseed crushing industry are in general agreement that the present seed grading plan marks, and in itself, constitutes an advance toward the rational purchase of cottonseed . . . a goal, the attainment of which will do more to improve the status of this industry than anything that we can at present visualize.

Since most of us are closely connected with this industry, we are indirectly affected by its condition. But to the chemists in particular, this grading plan means more than this. At the same time it marks a new era in the application of our science to this industry, not only offering an opportunity to function in a new field, but wholly changing the status of the chemist to mill relationship; it opens a new field of information, rich in its own significance and in its bearing upon other cottonseed crushing problems with which we all, more or less, have been thrown into intimate contact; lastly, it presents a problem which will require all of our ingenuity and capacity to solve successfully.

First, consider the new service we are called upon to offer. It has been felt, perhaps since the very inception of the industry, that successful management to a great degree is contingent upon an exact and opportune knowledge of raw material, in this case . . . cottonseed, value. Many devices have been tried in an effort to supply this information. Probably the first of these to be made use of was past crushing experience. This is still being used, but as it is accumulated it points out its own defects and limitations. Aside from its apparent inaccuracy, it entirely fails insofar as it leads to a tentative conception that all seed are of equal value, something that is manifestly not true. Everyone knows that seed vary from place to place and from time to time and that crushing experience representing an average condition offers no information or measure of this variation. Under this management method, seed buying in which quality and yields were at all considered, soon became a guess as to how much more or less than the average, a certain lot of seed was worth.

Many methods have been tried and used in attempting to eliminate this guess. The mill test was often applied, in which exact quantities of seed were worked and the yields obtained therefrom carefully measured . . . This, of course, offers an approximation, but it was clumsy, expensive and at times, particularly during the crest of the seed movement, impossible to undertake. Besides, the information was always past history and of little value as an index of what might be expected in the immediate future. This effort toward solution has, in the past, called forth sporadic use of chemical analysis. Development along this line was slow due to the impossibility of determining how accurate an analysis might be, and further to the difficulty of translating the chemical analysis into its manufacturing import.

Early Grading Plans

ONE answer to the problem was the early adoption of a seed grading plan applicable at the time of seed receipt. This plan as you know . . . from the quantitative side, was based upon the amount of moisture and foreign matter present in the seed and, indiscriminately mixed, in the qualitative and quantitative phases, upon the percent of damaged and immature seed present. The plan, rough at best, served only to protect the buyer from excessive loss through exceptionally low quality seed. It made no attempt to differentiate one sound seed from another, between which we know there can be a great difference in value. Its qualitative phase was only in the remotest manner indicative of seed condition. The long life of

*Presented at the Twenty-second Annual Meeting, American Oil Chemists' Society, New Orleans, May 13-14.

this grading plan is perhaps best explained by the difficulties inherent in the grading of a commodity so variable in composition and quality and yielding so many products as does the cottonseed.

As early as 1912, the Bureau of Markets undertook a survey of the chemical constituents of cottonseed. About 1913 or 1914, the investigation was abandoned as not being promising with reference to the establishment of grades. Again in 1924, the grading problem received government recognition when G. S. Meloy, Senior Marketing Specialist of the Department of Agriculture, was invited to meet with the industry then in convention here in New Orleans with the idea of establishing, if possible, grades for both cottonseed and linters. Mr. Meloy first undertook and solved the linter problem, and it was not before 1926 that the seed were given any consideration. The first tentative plan offered by Mr. Meloy was based upon the percentage of meat as a measure of the quantitative value of cottonseed, while the percentage by number of discolored seed was suggested as the measure of quality. In 1927, the percentage of free fatty acid in seed was substituted for that of discolored seed. The development of this plan was slowed and eventually stopped by the impossibility of obtaining a mechanical means for quantitatively separating the meats from the hulls of cottonseed. Mr. Meloy's studies were interrupted by a South American trip during 1928. In the meantime, some of our industry had been studying and investigating the possibility of quantitative seed grading by means of chemical analysis. The possibility of making use of chemical analysis along with certain basic assumptions pertaining to the relative value of ammonia and oil was adopted by Mr. Meloy upon his return, as the most promising means of grading. The first official recommendation to this effect was proposed before the convention of the Interstate Cottonseed Crushers Association in May, 1928. From this proposal, the present plan has evolved.

It is worth pointing out here that the use of chemical analysis as the means of grading is neither perfect nor complete . . . Quantitatively, it gives no direct information on the yields of two products, lint and hulls, which together, amount to from ten to fifteen percent of the seed value. One of its prime assumptions is an average relationship between the value of oil and cake, which like most averages, is rarely applicable. The information that chemical analysis supplies is not what can be gotten from seed, which in fact determines seed value, but rather what seed contain. The criterion of quality is the condition of oil with respect to its acid content, which is still only a very indirect measure of the relative qualitative value of seed. Considering these things, we might well picture the calling forth of the chemists' aid as a step in the evolution toward . . . and not necessarily the final solution of the seed grading problem. The chemist has been asked to perform this new and additional service for the industry, but the issue is still in the balance. There has been and still is much doubt as to whether chemical methods when applied to individual samples can be made accurate and uniform enough to support a grading plan. Although in the past there has been much needless exaggeration of the analysis error caused by its confusion with the sampling error, we know that up to the present the results from chemical analysis alone have not proven entirely satisfactory. Unless rapid improvement in this respect is possible, the grading plan and the opportunity to function in this new field is inevitably doomed to the limbo of "noble experiments."

Seed Analysis at Present

THE present status of seed analysis is about as follows:

A committee from the Bureau of Chemistry and Soils and the Bureau of Agricultural Economics headed by Messrs. Meloy and Jamieson after two years work ending more than a year ago offered a method of analysis, which after cooperative modification and improvement by that committee and the Chemists' Committee of the National Cottonseed Products Association, appears to be accurate to approximately 0.20% in oil and 0.05% in ammonia. Looking over the experience of the past year, it is found that when duplicate samples were sent to different laboratories, and sometimes to the same laboratory, the reported results were often much farther apart than this limit of accuracy would indicate they should be. In some cases when one and the same sample was analyzed twice by one laboratory, variations of about 1.0% in oil and 0.15% in ammonia were reported. This can indicate only that either some error of procedure or some unusual laboratory condition has entered into the analysis. The elimination of these wide variations is at least to some extent the responsibility of the individual chemist.

Such variations, besides being in conflict with and nullifying the prime object of the analysis, may lead to the development of situations having serious consequences to the mill operator. On buying seed, it is usually found that the sellers, particularly those who store large quantities of seed in one house, expect the seed to run uniform in index and incidentally, at the level of the highest preceding analysis. If,

because of a change, real or otherwise, or for any other reason it becomes necessary to run a second test upon a seed shipment and this test does not check the first reported results, then all parties concerned soon come to the conclusion that to get any desired result, it is only necessary to repeat the test often enough. Under such conditions, the only analysis acceptable to the seller is that which corresponds to a premium on seed. The penalties or discounts become no longer enforceable and we have no grading plan. Further, variations in analysis might impair the prestige of a mill operator. Chance low and high results can easily lead to the creation of an unknown reputation as either an acceptable or unacceptable purchaser.

Accuracy of Averages

SOMEWHAT in contrast to the wide variations and apparent inaccuracy of the individual analysis is the accuracy of information, based upon averages. The accuracy of average chemical information, even when only a relatively few analyses go to make up this average, is fairly well substantiated. It appears that the variations occurring in the single test are of a compensating nature. Illustrative of that is a test in which one laboratory on analyzing twenty-five samples in duplicate found variations in the duplicate tests, which in one instance were as high as 0.33% in oil and 0.10% in ammonia. However, the averages of the first as compared with that of the second of these duplicate determinations are no farther apart than 0.02% in both oil and ammonia. In another test of the same sort, where variations in duplicate tests were as high as 0.7% in oil and 0.14% in ammonia, the averages agree to within 0.17% in oil and .01% in ammonia.

A more remarkable indication of the trustworthiness of average chemical information is seen in the results of two tests, each involving twenty-five samples of as many different seed shipments. In each test, two samples were taken, each sample being taken by a different method. The analyzed results of individual samples representing the same seed shipment, differed from one another by as much as 1.6% in oil and 0.25% in ammonia. Still the averages of the different samples agreed in one test to within 0.1% in oil and 0.02% in ammonia, and in the other test to within 0.26% in oil and 0.01% in ammonia. Still another indication has to do with the oil and ammonia accounting of four mills at which the oil and ammonia content of all products, as well as of seed, were determined. When the oil in seed is compared with the oil in products plus the oil produced, the average accounting for the four mills is 101.1% with a maximum of 102.0% and a minimum of 100.0%. Comparing the ammonia in products with the ammonia in seed, the average accounting was 99.7% with a maximum of 101.6% and a minimum of 98.5%.

While average information is irrelevant to the operation of a grading plan, it is of quite some importance to the mill. If correct, through a balance between raw material and finished products, in terms of oil and protein content, a new method of mill accounting becomes available. Again with this information, it is possible to refer our present methods for measuring efficiency back to a determinable and definite basis. This basis, namely, the constituents and the condition of the seed, we already know . . . influences the efficiency of the mill when that efficiency is expressed in our present terms of extraction standard, quality of oil, yield of cake, etc. Lack of seed information has been in the past . . . the last and always unfailing source of alibi for poor results. Almost invariably, the inexplicable in mill operation has been unhesitatingly referred to and satisfactorily explained by seed peculiarities.

Correlative Applications

THERE are other uses to which average information may be put. For example, it may be used to determine the deterioration that has taken place in seed during mill storage. However, with reference to deterioration, it not only measures what has taken place, but it may serve as a guide and as a warning as to whether or not a specific lot of seed is liable to deteriorate. In addition, there is quite a mass of information of indirect benefit that becomes available through the chemical analysis of seed which at first glance appears to be purely theoretical, but which doubtless has real practical value and in itself, is highly interesting. I have reference to the information which the analysis offers us on the quality of seed being produced in certain seed growing territories. Anyone who has been long connected with the cottonseed crushing industry has, before very long contact, developed certain conceptions about the quality of seed from a limited and peculiar territory. Very often, they influence the actual management of the business. It is astonishing how many of these conceptions have been either modified or destroyed by the information which one year's operation of the grading plan has made available. It is surprising, too, to learn through the operation of the grading plan that there seem to be regular types of seed existing over relatively large territories for which it is easy to account. I have in mind two situations in Texas.

Starting from the Brazos River on the north and going southward to the Rio Grande, we

find a regular and gradual change in seed, in which the oil content slightly diminishes and the ammonia content slightly increases. Starting from the coast line and going westward, there is a gradual and progressive increase in the ammonia content of seed. It so happens that the rain-fall map of Texas shows a progressive decrease from east to west, along lines parallel to the Gulf. The correlation of seed to weather, in particular . . . rainfall, is here so regular that you could almost plot the rain-fall map of Texas, using the ammonia content in seed as the basis of information. The southern tip of Texas is an arid section of which a strip along the Rio Grande has been artificially irrigated. It is actually possible to mark the map line . . . separating the irrigated from the unirrigated section by the difference that exists, in the average chemical analysis of seed. The unirrigated portion of the valley grows a higher ammonia and lower oil content seed than the irrigated portion.

It is all this secondary, but still valuable information that makes desirable the grading of seed by use of chemical analysis. From the standpoint of utility, the multiple function of chemical analysis is very impressive. Because of this, it will doubtless have a decided effect upon the relationship of the chemist to the mill. At present, the superintendents and managers in most of our mills picture the chemist's prime . . . if not sole function to the pointing out of mistakes that are up to the superintendent to correct. Now for the first time, the chemist is offering information which will help in the explanation, solution and avoidance of mill problems and difficulties. You will find most of the mills making a real effort to utilize the information offered by the seed analysis. The new possibilities offered will inevitably bring about a change of the mill management's viewpoint. They will make the chemist the operating ally, rather than the judge of the mill operation, which in turn will lead to a reduction of any existing resistance to further application of chemistry to mill problems.

These many ramifications of the chemical analysis indicate the present type of grading plan to be one, which if effective, will work not only to the benefit of the farmer, but also to the mutual benefit of the chemist and the mill. The industry has offered the opportunity. It is the job of the chemists to provide the means. So far, and perhaps of necessity, progress in proving the efficacy of chemical analysis has been slow. Nothing will contribute more to this progress than wholehearted cooperation and a sustained effort by the individual chemist to apply all his skill to the everyday seed analysis.

Palm Oil Industry of Nigeria

The Bureau of Foreign and Domestic Commerce has received from Trade Commissioner Schwarz, Accra, Gold Coast, an extensive report dealing with the many phases of the palm oil industry of Nigeria. This report is available for the asking to those interested and who may transmit requests to this section.

Some of the high lights of the report are the following: The revelation that the native women and children in the oil palm belt of Nigeria crack out by hand well over a quarter of a million tons of palm kernels annually; that the barter of products for merchandise was officially abolished a year ago, but still lingers on in some sections due to native volition, preference and custom. Tree climbing in palm nut gathering assumes the aspects of a profession in some parts of Nigeria. The government is experimenting with an orderly planting program to eliminate stands of "bush" palms. The standards of quality of palm oil and kernels have been vastly improved by enforcement of grading regulations and last year this inspection was extended to 400,000 tons of produce. The installation of bulk palm oil loading and storage facilities is progressing steadily at different river points.

The government is now engaged in a scheme to promote the attainment of better quality native oil by the introduction of modified mechanical equipment and the offer of a subsidy to approved mills that may be constructed. To date, however, advantage has not been taken of the government's offer. Adoption of mechanical equipment by natives is meeting with more success. A detailed description is given in the report of native methods of producing soft and hard oils; also data are included giving exports, relative importance of different ports, average monthly prices at various stations.

Procter & Gamble Co., Cincinnati, is sponsoring a new radio broadcast program over the National Broadcasting System's chain. Beginning July 7 Eddie East and Ralph Dumke, "The Sisters of the Skillet," started a series of broadcasts three days a week from 8:45 to 9:00 P.M. over the NBC-WJZ network.

The total area sown to sesame seed in India during the 1930-31 season is estimated to be 5,551,000 acres and the production to be 523,000 tons. Last season the acreage was 5,345,000 acres and the production 455,000 tons.

Sapote (Mammy Apple)* Seed and Oil

Contribution from the Oil, Fat and Wax Laboratory, Bureau of Chemists and Soils, U. S. Department of Agriculture

By G. S. JAMIESON *and* R. S. MCKINNEY

THE oil to be described is found in the seed from the fruit of *Calocarpum mammosum* (formerly classified as *Achras mammosa, sideroylum sapota, Vitellaria mammosa* and by other names) belonging to the Sapotaceæ family. For those not specially familiar with this interesting family of tropical plants, the following information is given:

Most of the species that are of interest on account of their oleaginous seeds are sizable trees found in India, the East Indies, and in parts of tropical Africa. Among these may be mentioned those that yield the true illipe or Bassia fats, katio oil, njatno oil and shea butter. With few exceptions the members of this family yield products that are more or less solid fats at ordinary temperatures and practically all of them are characterized by containing large quantities of saturated acids, and not infrequently, as in the case of sapote oil, stearic acid predominates. Recently, Pieraerts, Adriaens, and Muelenburg (*Les Mat. Gras.* 1929, 21, 8701 and 1930, 22, 8782) have found that another species, *Dumoria africana,* from the Belgian Congo yields a fat which contains 46 per cent of saturated acids, the larger part of which is stearic acid, and they call attention to the ease with which this acid can be obtained in quantity from this source.

The sapote or "marmalade tree" which is now cultivated chiefly for its fruit is a native of tropical America. It is found in southern Mexico, Central America, Colombia, Ecuador and other tropical regions. This tree under favorable conditions reaches a height of 30 meters. The brown scaly globose or ovoid fruits which range in length from 10 to 20 centimeters contain one large tapering seed about 8 centimeters long and 3 centimeters at the larger diameter. These seeds generally weigh from about 20 to 26 grams. The pink flesh or pulp of the fruit which has a peculiar sweetish flavor is eaten as such or converted into a beverage, marmalade or jelly. The seeds, which have a flavor resembling that of bitter almonds, are ground in some localities and used in making sweetmeats. From very early times the seed oil has been used by the native inhabitants for dressing the hair. It was believed that its use prevented the falling out of the hair. C. Gayton (*Jour. de. Pharm.* 1840, 26, 771) called attention to the large quantity of oil in the seed and showed also that it contained notable quantities of amygdalin, which accounts for its characteristic flavor. This was later confirmed by F. Altamirana (*La Naturaliza* 1874, 3, 138) who also stated that the oil was used for toilet purposes by the natives. Apparently since this time the oil has not received any attention on the part of the investigators, although it is understood that considerable quantities of the seed are available in some of the localities in which the trees are cultivated.

Some years ago through the Department's Office of Foreign Plant Introduction a quantity of sapote seed was obtained from D. Massin at Guinea Grass, Honduras. An analysis of the seed showed that they contained 9.4 per cent of moisture and 57 per cent of oil. The oil was expressed from the seed by means of the Anderson oil expeller. After standing for more than eight years in cold storage it still possessed a faint almond-like odor and had a very mild pleasant taste. When cooled to about 15° this bright yellow oil solidified. Upon standing a short time between 23° and 27° large quantities of stearin were deposited, as would be expected from its composition.

The chemical and physical characteristics of the oil, which were determined after it had

*This fruit should not be confused with another of the American tropics known as "Mamme Apple," which is from the tree *Mammea americana* belonging to the natural order of *Guttiferae.*

†Presented at the Twenty-second Annual Meeting, American Oil Chemists' Society, New Orleans, May 13-14.

been held in storage at 2° C. for more than eight years, are given in Table I.

Table I

Specific gravity 25/25°	0.9105
Refractive index at 25°	1.4652
Iodine number (Hanus)	70.2
Saponification value	189.5
Acetyl value	12.2
Unsaponifiable matter, per cent	1.39
Reichert-Meissl value	0.15
Polenske number	0.30
Saturated acids, corrected, per cent	30.37
Unsaturated acids, corrected, per cent	63.73

The saturated and unsaturated acids were separated and determined by the lead-salt ether method (*J. Assoc. Offic. Agric. Chemists* 1928, 11, 303), and corrections were made for the small quantity of unsaturated acids that is precipitated and weighed with the saturated acid fraction. The percentage of unsaturated acids has also been corrected for the unsaponifiable matter that remains with them. It will be observed that the oil, which distinctly belongs to the non-drying class, is characterized by having a large percentage of saturated acids.

Unsaturated Acids

FROM the iodine number of the oil and the corrected percentage of unsaturated acids, the iodine number of the latter was calculated to be 108. This value was used in the calculation of the proportions of oleic and linolic acids in the oil with the following results:

	Unsaturated Acids Per cent	In Oil Per Cent	As Glycerides Per Cent
Oleic acid	80.2	52.15	53.4
Linolic acid	19.8	12.88	13.1

Saturated Acids

THE saturated acids, which were separated from the oil by the lead-salt ether procedure, were esterified with absolute methyl alcohol in the presence of dry hydrogen chloride (*Jour. Amer. Chem. Soc.* 1920, 42, 1920), and the resulting esters were fractionally distilled under diminished pressure. About 110 grams of the esters were distilled from a 500 cc. Claissen flask, giving five fractions and a residue, which were then refractionated in order from a 150 cc. Ladenburg fractionation flask. Six fractions and a small residue were obtained. At 5 millimeters pressure the bulk of the esters was found to distill between 185° and 197°. The iodine number and the saponification value of each fraction were determined. An examination of the acids separated from the undistilled residue showed that they consisted chiefly of stearic acid and a very small quantity of arachidic acid which melted at 77°.

The free fatty acids were recovered from portions of each of the fractions of esters in the usual manner after saponification with alcoholic potash, and submitted to fractional crystallization from ethyl alcohol. Their identity was established by the melting points and by observing whether or not they were lowered when the substances were mixed with equal quantities of the respective acids, the purity of which had been established by analysis. In no case was there any change in the melting point, and the acids separated from each fraction were in accordance with the deductions drawn from the mean molecular weights as calculated from the analyses of the esters. The quantities of saturated acids in the fractions were calculated from the mean molecular weight of their esters and the theoretical molecular weight of the two esters in each one. The final results are given in Table 2.

Table 2

Acids	Grams	Per Cent	Acids in Oil Per Cent	Glycerides in Oil Per Cent
Palmitic	28.3019	30.95	9.40	9.86
Stearic	63.0861	68.99	20.95	21.89
Arachidic	.0500	.06	.02	.02

The oil is characterized by the large quantity of stearic acid present, and this accounts for the ease with which it solidifies when slightly cooled.

The composition of the expressed oil has been determined, with the following results:

Glycerides of	Per Cent
Oleic Acid	53.4
Linolic Acid	13.1
Palmitic Acid	9.9
Stearic Acid	21.9
Arachidic Acid	Trace
Unsaponifiable	1.4

The oil could be used as a cooking oil, as a salad oil in tropical countries, or for the manufacture of soap.

In the use of brucine alkaloid as a denaturant for technical vegetable oils, trouble may be encountered if the brucine is dissolved in alcohol, according to The New York Quinine and Chemical Works, manufacturers of brucine alkaloid. The preferred method for the use of this alkaloid as a denaturant makes use of the following formula:

Brucine Alkaloid, 2 lbs. Commercial oleic acid, 1 quart, 12 fluid ounces. Vegetable oil, 1 quart, 1 pint. Heat the oleic acid to 90° C. Add the brucine alkaloid slowly with constant stirring. When the solution is clear, add the vegetable oil. Heat to 90° C. Mix well.

One pint of this solution contains four ounces of brucine alkaloid; the solution will not precipitate crystals on cooling and is miscible in all proportions with vegetable oils.

Soap Analysis Committee Report

Methods for Unsaponified and Unsaponifiable Material Reviewed and checked by Co-operative Analyses

By H. P. TREVITHICK, *Chairman*

IN 1922, a complete set of soap methods adopted by a committee consisting of representatives of various soap manufacturers and the Bureau of Standards, etc., under the leadership of Archibald Campbell. These methods were given to this committee for review.

The most pressing problems apparently were the determinations of the unsaponifiable and unsaponified matters in soap samples. The methods prescribed the use of ethyl ether in these tests. The use of this solvent has very many disadvantages: first, the soap is soluble in the solvent, and is carried into the other solution, from which it must be removed by washing with water, but then the water washings must be extracted again: second, it is very apt to cause troublesome emulsions which are very difficult to break: third, due to the fact that alcohol and ether readily dissolve in each other in all proportions, the soap solution must be an aqueous one, free from alcohol. This causes hydrolysis of the soap, and consequent liberation of fatty acids and caustic, the fatty acids dissolving in the solvent and thus going into the extract. The weight of this extract must be corrected, by dissolving in petroleum ether to ensure freedom from soap (this ingredient must be weighed and allowed for if present) and then titrating with caustic alkali in neutral alcohol solution to obtain the correction for fatty acid content. This last correction frequently is so large that it represents 80 or 90% of the total residue, and in our opinion, is so large that it destroys practically the value of the whole test.

Petroleum ether does not have these disadvantages, as soap is only slightly soluble in it, hydrolysis in the 50% alcoholic solution is almost negligible, and emulsions are not easily formed. It is also the standard solvent in the F. A. C. methods for fats and greases. We, therefore, decided to check this method on soap.

Two samples of soap, a straight tallow soap, and the same tallow soap containing 20% rosin, were prepared by one of our members, Mr. W. A. Peterson, and mailed to the members with instructions to make the following tests on each:

A—Determine the unsaponified plus unsaponifiable by petroleum ether by the method of the Committee on the Analysis of Commercial Oils and Fats of The American Oil Chemists' Society and the American Chemical Society, usually referred to as the F. A. C. Committee.

B—After completing the extraction, remove the alcohol by evaporation, redissolve the soap in water, and extract three more times with ethyl ether, correcting the extracts for any fatty acids and soap present.

C—Determine the same constituents by the straight method as prescribed by the American Chemical Society method using ethyl ether and making the usual corrections.

Of course, it was not necessary to saponify the sample in any of these tests above, but simply to start by dissolving the soap in the required solvent and then to extract.

Then determine the unsaponifiable matter by the same three methods, A, B and C, of course, saponifying the soap, etc. Also the moisture content was to be determined.

The results of these tests by 7 analysts are shown in Tables I to IV. Four of the members of the committee have not yet been able to complete the work for various reasons. Each table shows the average value, and the maximum and minimum values for each column, and the gross and corrected or net figures for each test as reported.

It is seen that the "F. A. C." method gives quite concordant and consistent results in all four tables, the deviations being not more than would be expected from the work of different collaborators, in most cases the corrections necessary being minor. In this test, the material is extracted from a 50% alcohol solution which tends to depress, if it does not completely eliminate, hydrolysis of the soap.

The additional extractions with ethyl ether, the results being shown in the 3rd and 4th columns, gave rather fantastic results, the gross results varying from 0.20 to 3.81 on Table I, 0.12 to 1.60 on Table II, 1.29 to 4.74 on Table III, and 0.74 to 1.98 on Table IV, while the net corrected values ran 0.0 to 0.25 on Table I, 0.0 to 0.25 on Table II, 0.0 to 0.94 on Table III, and 0.0 to 0.74 on Table IV, the corrections being many times the net results in most cases, so that it seems probable that the net results should be negligible in all cases.

The results by the straight official method as at present prescribed also show very large corrections, the gross values varying from 1.86 to 2.93 on Table I, and from 2.89 to 6.53 on Table III. The net values also show large variations, which are due we believe to the difficulties inherent in the method, the length of time required (several days) and the number of pieces of apparatus required, with consequent enhanced chances of loss, spillage, etc.

In all four tests, the petroleum ether extract seems somewhat less than the ethyl extract, but this may be partially due to the fact that the corrections as applied to the ethyl ether method are not sufficiently exact. Further, we believe that no method should be adopted where the corrections are much larger than the net results, as the chances of errors creeping in are too great.

We, therefore, recommend that these methods for the determination of unsaponifiable, unsaponified plus unsaponifiable, and unsaponified saponifiable matter be rewritten to agree with the F. A. C. procedure.

The methods, as we suggest them, are as follows:

Soap Analysis

Unsaponified & Unsaponifiable Matter:

Extraction Cylinder:

The cylinder shall be a 250 cc. glass stoppered cylinder about 35 mm. (1⅜″) in diameter and about 30 cm. (12″) high.

Petroleum Ether:

Redistilled petroleum ether, American Oil Chemists' Society specifications, shall be used. A blank must be made by evaporating 250 cc. with about 0.25 gram of stearin or other hard fat (previously brought to constant weight by heating) and drying as in the actual determination. The blank must not exceed a few milligrams.

Determination:

Weigh 5 grams (± 0.2 gram) of the prepared sample into a 250 cc. Erlenmeyer flask or beaker which contains approximately 0.1 gram bicarbonate of soda, and dissolve in 100 cc of 50% redistilled ethyl alcohol. Warm and shake to effect solution, keeping the temperature under 60° C., and filter off any undissolved residue on a Gooch crucible with an asbestos pad or in a funnel using an asbestos pad deposited on a perforated porcelain disc. Wash three times with hot 50% alcohol and then with 5 cc. of hot 95% alcohol. Wash with a small amount of petroleum ether to remove any traces of unsaponified and unsaponifiable. Transfer the entire alcohol — water and ether filtrate to the extraction cylinder and make up to the 160 cc. mark with 50% redistilled ethyl alcohol. Add 50 cc. of petroleum ether, shake vigorously for one minute and allow to settle until both layers are clear. The volume of the upper layer should be about 40 cc. Draw off petroleum ether layer as closely as possible by means of a slender glass siphon, into a separatory funnel of 500 cc. capacity. Repeat the extraction at least six times using 50 cc. of petroleum ether each time. Wash the combined ether extracts in a separatory funnel first with a mixture of 15 cc. of N/10 sodium hydroxide solution and 15 cc. of 95% alcohol, and then three times with 25 cc. portions of 10% alcohol, shaking vigorously each time. Transfer the petroleum ether extract to a beaker and evaporate the petroleum ether on a steam bath in an air current.

Test the residue for solubility with 50 cc. of petroleum ether at room temperature. Filter and wash free from the insoluble residue, if any; evaporate and dry in the same manner on the steam bath in a current of air, and finally in an air oven at 101° C. for 30 minutes. Weigh and return to the oven, re-weighing at 15 minute intervals until constant weight is reached. Take up the residue in 50 cc. of warm ethyl alcohol, neutralized to phenolphthalein, titrate to the same color as original neutral alcohol with N/25 sodium hydroxide solution and calculate to oleic acid. Deduct this figure from the gross weight previously found and report as "Unsaponified and Unsaponifiable Matter."

NOTE: Any blank from the petroleum ether must be deducted from the weight before calculating the unsaponified and unsaponifiable matter.

NOTE: Any free fatty acids in the soap, (titrated in 50% alcohol solution and calculated to oleic acid) must be added to the corrected figure for "Unsaponified and Unsaponifiable Matter."

Unsaponifiable Matter:

Determination:

Weigh 5 grams (± 0.2 gram) of the prepared sample into a 200 cc. Erlenmeyer flask. Add 30 cc. of redistilled 95% ethyl alcohol and 5 cc. of 50% aqueous potassium hydroxide and boil the mixture for one hour under a reflux condenser. Transfer to the extraction cylinder and wash to the 40 cc. mark with redistilled 95% ethyl alcohol. Complete the transfer, first with warm then with cold water till the total volume is 80 cc., and finally with a small quantity of petroleum ether. Cool the cylinder and contents to room temperature and add 50 cc. of petroleum ether; and then proceed with the extraction as outlined above under "Unsaponified and Unsaponifiable Matter," except the alkaline wash may be omitted; weigh the residue and correct for fatty acids in the usual manner. Report the result as "Unsaponifiable Matter."

From the total Unsaponified and Unsaponifiable Matter figure as found above, deduct the Unsaponifiable figure and report as "Unsaponified Matter."

The Committee wishes to emphasize the necessity of thorough and vigorous shaking in order to secure accurate results. The two phases must be brought into the most intimate contact possible; otherwise low and disagreeing results may be obtained.

NOTE: The above method will not remove all the unsaponifiable matter in soaps to which lanolin has been added. Many more extractions are required when substances of this nature are present.

Respectfully submitted;

A. K. Church, L. M. Roeg, W. A. Peterson, R. B. Trusler, C. P. Long, W. D. Richardson, W. H. Burkhardt, M. L. Sheely, M. H. Ittner, H. P. Trevithick, *Chairman.*

TALLOW SOAP
UNSAPONIFIED PLUS UNSAPONIFIABLE
(Table I)

ANALYST	F. A. C. Gross	F. A. C. Net	Add'l Ethyl Ether Gross	Add'l Ethyl Ether Net	American Chemical Society Gross	American Chemical Society Net
No. 1.	0.90	0.34	0.13	0.06	—	—
	0.97	0.35	0.27	0.11	—	—
No. 2.	0.36	0.31	0.76	0.26	2.86	1.23
	0.36	0.31	0.90	0.23	3.00	1.08
No. 3.	0.51	0.40	1.20	0.10	—	—
	0.48	0.40	1.25	0.09	—	—
No. 4. A. (5 extractions)	—	0.25	—	0.0	—	0.22
	—	0.26	—	0.0	—	0.24
	—	0.26	—	0.0	—	0.26
	—	0.26	—	0.0	—	0.27
B. (7 extractions)	—	—	—	—	—	—
C. (Stokes Flask used) (5 extractions)	—	0.28	—	0.0	—	—
	—	0.26	—	0.0	—	—
	—	0.27	—	0.0	—	—
	—	0.28	—	0.0	—	—
No. 5.	0.42	0.37	0.32	0.05	2.14	0.54
	0.35	0.30	0.35	0.06	1.58	0.27
No. 6.	0.56	0.23	3.81	0.07	1.89	0.35
No. 7. A.	0.32	0.29	—	—	—	0.68
	0.32	—	—	—	—	0.77
B.	0.32	0.30	—	—	—	—
	0.34	—	—	—	—	—
AVERAGE	0.49	0.31	1.28	0.08	2.23	0.58
MAXIMUM	0.94	0.40	3.81	0.25	2.93	1.16
MINIMUM	0.32	0.23	0.20	0.00	1.86	0.25

TALLOW SOAP
UNSAPONIFIABLE
(Table II)

ANALYST	Moisture	F. A. C. Gross	F. A. C. Net	Add'l Ethyl Ether Gross	Add'l Ethyl Ether Net	American Chemical Society Gross	American Chemical Society Net
No. 1.	2.77	0.30	0.25	0.10	0.05	—	—
		0.30	0.25	0.13	0.06	—	—
No. 2.		0.26	0.18	0.74	0.28	1.30	1.19
		0.26	0.19	0.66	0.22	1.22	1.13
No. 3.	3.45	0.32	0.32	0.83	0.02	—	—

Table II—*Continued*

			0.29	0.29	0.73	0.08	— —
No. 4.	A. (5 extractions)		—	0.24	—	0.0	— 0.20
			—	0.24	—	0.0	— 0.23
			—	0.24	—	0.0	— 0.24
			—	0.24	—	0.0	— 0.25
	B. (7 extractions)						
	C. (Stokes Flask used) (5 extractions)						
		3.58	—	0.26	—	0.0	— —
		3.56	—	0.24	—	0.0	— —
		3.59	—	0.25	—	0.0	— —
			—	0.26	—	0.0	— —
No. 5.		3.55	0.24	0.24	1.97	0.08	1.22 0.32
		3.49	0.27	0.27	1.22	0.03	1.42 0.37
No. 6.			0.48	0.18	0.42	0.09	0.48 0.09
No. 7.	A.	2.52	0.29	—	—	—	— —
		2.60	0.28	0.29	—	—	— 0.50
	B.		0.26	—	—	—	— —
			0.28	0.27	—	—	— —
	C.		0.24	—	—	—	— —
			0.28	0.26	—	—	— —
AVERAGE		3.18	0.32	0.25	0.72	0.07	1.02 0.47
MAXIMUM		3.59	0.48	0.31	1.60	0.25	1.32 1.16
MINIMUM		2.56	0.26	0.18	0.12	0.00	0.48 0.09

ROSIN TALLOW SOAP
UNSAPONIFIED PLUS UNSAPONIFIABLE

(Table III)

ANALYST		F. A. C. Gross	F. A. C. Net	Add'l Ethyl Ether Gross	Add'l Ethyl Ether Net	American Chemical Society Gross	American Chemical Society Net
No. 1.		1.77	1.60	1.10	0.84	—	—
		1.73	1.66	1.47	0.94	—	—
No. 2.		1.58	1.54	1.80	0.90	6.48	2.81
		1.62	1.56	1.78	0.98	6.58	2.80
No. 3.		1.83	1.67	2.44	0.58	—	—
		1.83	1.67	—	—	—	—
No. 4.	A. (5 extractions)						
		—	1.51	—	0.02	—	1.66
		—	1.60	—	0.03	—	1.66
		—	1.60	—	0.02	—	1.67
		—	1.68	—	0.03	—	1.68
	B. (7 extractions)						
		—	1.67	—	—	—	—
		—	1.63	—	—	—	—
		—	1.65	—	—	—	—
		—	1.64	—	—	—	—
	C. (Stokes Flask used) (5 extractions)						
		—	1.60	—	0.0	—	—
		—	1.61	—	0.0	—	—
		—	1.63	—	0.0	—	—
		—	1.64	—	0.0	—	—
No. 5.		1.44	1.23	2.62	0.62	3.40	1.80
		—	—	—	—	3.40	1.80
No. 6.		1.62	1.31	4.74	0.66	2.89	2.49
No. 7.	A.	1.16	—	—	—	—	—
		1.08	1.04	—	—	—	2.72
	B.	1.10	—	—	—	—	—
		1.08	1.00	—	—	—	2.75
AVERAGE		1.49	1.43	2.58	0.53	4.27	2.37
MAXIMUM		1.83	1.67	4.74	0.94	6.53	2.81
MINIMUM		1.09	1.00	1.29	0.00	2.89	1.67

ROSIN TALLOW SOAP
UNSAPONIFIABLE
(Table IV)

ANALYST	Moisture	F. A. C. Gross	F. A. C. Net	Add'l Ethyl Ether Gross	Add'l Ethyl Ether Net	American Chemical Society Gross	American Chemical Society Net
No. 1.	0.20	1.60	1.45	0.77	0.74	—	—
		1.60	1.40	0.73	0.73	—	—
No. 2.		1.36	1.30	1.32	0.74	2.80	1.32
		1.42	1.39	1.24	0.70	2.50	1.19
No. 3.	0.60	1.63	1.61	1.43	0.53	—	—
		1.61	1.58	1.97	0.67	—	—
No. 4. A. (5 extractions)							
		—	1.51	—	—	—	1.60
		—	1.50	—	—	—	1.59
		—	1.54	—	—	—	1.66
		—	1.57	—	—	—	1.66
B. (7 extractions)							
		—	1.60	—	—	—	—
		—	1.61	—	—	—	—
		—	1.60	—	—	—	—
		—	1.60	—	—	—	—
C. (Stokes Flask used) (5 extractions)							
	0.84	—	1.52	—	0.0	—	—
	0.83	—	1.55	—	0.0	—	—
	0.85	—	1.57	—	0.0	—	—
		—	1.58	—	0.0	—	—
No. 5.	0.74	1.06	1.06	2.47	0.23	2.97	1.62
	0.60	0.91	0.91	1.49	0.23	2.87	1.47
No. 6.		1.25	1.06	0.74	0.15	1.58	0.94
No. 7. A.	1.54	0.90	—	—	—	—	—
	1.50	0.84	0.87	—	—	—	1.72
B.		0.86	—	—	—	—	—
		0.84	0.85	—	—	—	—
		(on dried soap)		(with ethyl ether)		Gross 0.91	Net 0.83
AVERAGE	0.78	1.22	1.28	1.09	0.41	2.02	1.42
MAXIMUM	1.54	1.60	1.60	1.98	0.74	2.82	1.62
MINIMUM	0.20	0.85	0.85	0.74	0.00	1.58	0.94

Butter consumption in Netherlands was 12% greater in 1930 than in 1929. This information, Commercial Attache Van Wickel, The Hague, furnishes in a recent report based on official Dutch statistics. Per capita consumption of margarine fell off .3 of a kilogram to 8.9 kilograms, from 1929 to 1930, whereas butter increased per capita .6 of a kilogram. The consumption of animal fats in the manufacture of margarine in 1930 was 71,035 metric tons, or nearly three times the quantity that entered into margarine in 1926 and approximately 50% more than the consumption in 1929. In the case of vegetable oils, consumption dropped from 118,000 metric tons in 1928 to 68,000 metric tons last year. There was a decline of 33⅓% between the years 1929 and 1930 in the use of vegetable oils.

Because of the average retail price of butter, the terms of percentage of prices prevailing for the period 1921-1925 dropped from the index figure of 90 in 1929 to 76 in 1930, whereas margarine underwent no downward revision. Consumption of the latter product was affected to the extent of a drop of 2%.

A large sugar company in the Matanzas Province is contemplating the planting of approximately 10,000 acres in sunflowers after the present grinding season is over. The company in question intends to process the resulting production of sunflower seeds themselves for the extraction of oil. No information is as yet available as to whether the oil will be exported to northern markets or whether it will be sold to the local manufacturers of vegetable compounds.

Due to the large surplus of soya beans North Manchuria officials are advocating that the farmers plant larger crops of wheat, kaoliang, and millet and decrease soya bean acreage. Reports conflict as to what extent these instructions have been followed by the farmers. The cable reports that farmers are adverse to planting wheat on account of the great hazard due to fall rains preventing maturity, therefore they are counting on planting beans in spite of advice of Government. Present estimates indicate soya bean acreage will be equal or slightly smiller than past year with slight increase in acreage of wheat, kaoliang and millet.

ABSTRACTS

David Wesson, Abstract Editor

Iron in fats and soaps may be determined by carefully ashing ten grams and determining the iron in the hydrochloric acid solution of the ash colorimetrically with standard iron solution and potassium sulfocyanate. Soaps are ashed in successive portions; a total of five grams is used and combustion is aided with a few crystals of ammonium nitrate. In a series of experiments on the development of brown spots, the unchanged soaps contained 1.4 to 1.8 milligrams and the discolored soaps up to 9.0 milligrams of iron per kilogram. *Seifensieder-Ztg.* 58, 110-12 (1931).

In a recently described plant for continuous oleic acid distillation, crude oleic acid, the filtrate from the hydraulic fatty acid press, is heated by combustion gases to 340° C. in a special tubular heater; the vapors are passed through a vertical purifying column, from which any nonvaporized liquid portion flows off at the bottom to a soft pitch reservoir, while the pure distilled oleic acid is condensed and gives up its heat to preheaters. *Chem. Abstr.* 25,3187 (1931).

The darkening of fatty acids obtained by the Twitchell process is said not to be due to the addition of sulfuric acid. All reagents used in the catalytic saponification process increase the depth of color of the fatty acids with increase in heating time. The presence of air also increases the color. *J. Soc. Chem. Ind., Japan.* 33, Suppl. Bind. 500-4.

Soap Section Report

THE work of the Soap Section was carried on during this year by the Detergents, Soap Analysis, and Glycerine Analysis Committees.

The Detergents Committee, James G. Vail, Chairman, continued its program on standard soil, and expects to have an interesting and instructive report to present at our meeting next fall. The Soap Analysis Committee, H. P. Trevithick, Chairman, devoted the year to work on developing methods for the determination of unsaponifiable matter in soaps. The committee recommends the adoption of the Fat Committee method for use on pure soaps, containing on rosin, lanolin, or tung oil; and that the committee shall continue to do further cooperative work to develop a method for use on filled soaps containing rosin, lanolin, etc. The Glycerine Analysis Committee, J. T. R. Andrews, Chairman, devoted its time to proving that a discrepancy exists between the results obtained by the specific gravity and bichromate methods of analysis on the one hand and the acetin method on the other, and the committee recommends that further cooperative work be done to determine the cause of such discrepancy.

I wish to make the following recommendations to the society covering the program for the Soap Section for the next year: That the Detergents Committee continue as at present organized until after its report at our next fall meeting. That the Soap Analysis Committee continue its cooperative work on developing a method for determining unsaponifiable matter in filled soaps containing rosin, lanolin, etc. That the Glycerine Analysis Committee continue its cooperative work on the cause of the discrepancy between the analysis of glycerine by the specific gravity and bichromate methods on one hand and the acetin method on the other as proven by the committee work this year. That a committee be appointed to review and revise the Standard Methods of Sampling and Analysis of Soap and Soap Products as adopted by the American Chemical Society and the American Oil Chemists' Society.

I wish to most strongly urge that all the members of the various committees favor their respective chairmen with all possible suggestions in order to broaden the scope of the work of the committee as well as to lighten the burden and responsibilities of the chairman. I wish to thank most heartily the officers of the society, the chairmen and members of the various committees, and the members of the Soap Section for the hearty response, keen interest, and conscientious effort, put forth in behalf of the work by our section during the past year.

ARCHIBALD CAMPBELL, *Chairman*

Anti-oxidants in Edible Oil Preservation*

Resistance to Oxidation Attributable to Presence of Minute Quantities of Added or Natural Inhibitory Catalysts

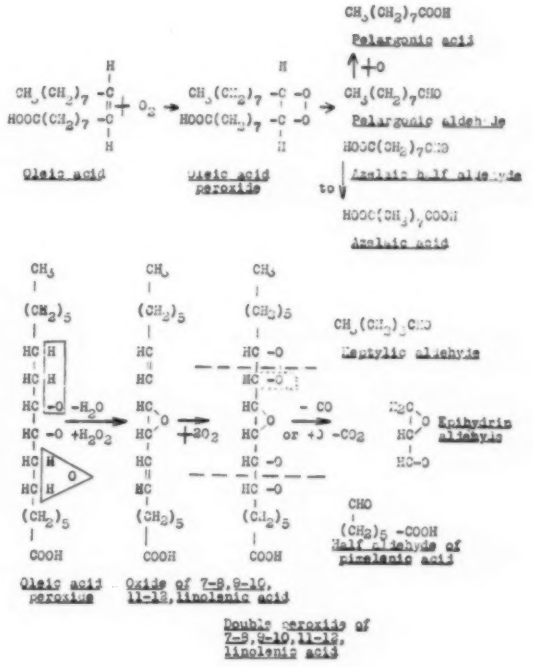
By F. C. VIBRANS

Part II

AN adequate review of Powick's research, although it would be very much worthwhile, cannot be undertaken at this time. From his study he concludes that "the odor of heptylic aldehyde ($C_6H_{13}CHO$) itself and in the presence of fresh fats is sufficiently suggestive of the rancid odor to establish the reasonableness of Scala's[13] contention that it is the component of rancid fats that is primarily responsible for their rancid odor." Powick, after an examination of nonylic aldehyde, suggests that this compound may be partly responsible for the rancid odor. He found the color obtained in the Kreis test on rancid fats was identical spectroscopically with that obtained in the Kreis test on mixtures of acrolein and hydrogen peroxide. The product formed was identified as epihydrin aldehyde $H_2=C+C+CHO$ (O). Because of its instability it could not be isolated, but its diethylacetal ($CH_2 + CH + CH(OC_2H_5)_2$ (O)) was synthesized. Powick does not think that the substance in rancid fat that gives the Kreis test is epihydrine aldehyde, but that epihydrine aldehyde is formed when the fat which gives a Kreis test is shaken up with concentrated hydrochloric acid.

To illustrate how Powick juggles the oxidation of oleic acid to get the compounds which have a rancid odor and give a positive Kreis test, I have prepared this chart.

Powick, Kerr and Sorber, Eibner and Pallouf[23], Tschirch[24], Holm, Greenbank and Deysher[25], and others have contributed to the chemistry of the oxidation of fats and oils. Whether they explained the oxidation process by assuming the formation of a peroxide or a peroxide like compound which some of them call an ozonide or a "moloxide," the suggested mechanisms are all more or less alike.



Oxidation of Oleic Acid (Powick)

The oxidation of fats and oils takes place in two stages. The first stage, called the inductive period, may be either short or long, depending on a number of factors, and during which the compounds of high oxidizing potential are accumulating in sufficient amount to start a more rapid oxidation. The second stage is one of rapid oxidation. In this second period the retarding effect of anti-oxidants has been overcome and oxidation proceeds unmolested.

There is considerable evidence to support the belief that fats and oils contain anti-oxidants, or else they take up pro-oxidants, from apparently no apparent source. It is well known that raw cottonseed oil keeps bet-

*Presented at Fall Meeting American Oil Chemists' Society, Chicago, November 14, 1930.

ter than the refined product. Of course this may be attributed to the refining process per se. but there is evidence available to support the belief that the refined oil keeps more poorly because of the removal during the refining process of an anti-oxidant. Mattill and Crawford[26] studied the keeping quality of raw extracted, raw expressed, and processed corn oil. Their data indicate that the petroleum ether extracted oil kept many times better than a corresponding raw expressed oil, which necessarily was heated hotter during processing than the extracted oil. The maximum temperature of the extracted oil was 50° C. The processed oils kept poorer than the raw oil from which they were prepared. More references of this nature might be cited, but sufficient have been presented to indicate that unprocessed fats and oils evidently contain anti-oxidants to protect them from atmospheric oxidation.

Experimental Data

TO determine the effect of known anti-oxidants on the keeping quality of lard, we have tested a number of them in our laboratory. The method we use is a modification of a method developed by Greenbank and Holm of the Bureau of Dairy Industry in Washington. It consists essentially of measuring with an automatic recording device the time in hours required for 10 cc. of fat contained in a specially designed flask when heated at a constant temperature of 90° C. to absorb 3 cc. of oxygen from the air contained in the flask. The following are a few of the data we have obtained in our laboratory and I present them to you to illustrate how the use of anti-oxidants may improve keeping quality of edible fats.

Sample	Antioxidant Added		O_2 Absorption
No. 12	None		14.5
" "	0.01	Agerite	21.4
" "	0.2	"	109.
" "	0.5	"	123.
" "	1.0	"	94.
No. 12	None		14.5
" "	0.01	Thymol	17.
" "	0.05	"	19.
" "	0.10	"	23.
" "	0.20	"	28.
" "	0.50	"	25.
" "	1.00	"	24.
No. 11	None		10.4
" "	0.01	Everite	16.4
" "	0.05	"	20.1
" "	0.10	"	32.
" "	0.20	"	40.
" "	0.50	"	40.
No. 32	None		13.1
" "	0.2	No. 1	24.
" "	0.2	No. 2	19.
" "	0.2	No. 4	63.
No. 35	None		5.7
" "	0.01	No. 5	7.6
" "	0.20	" "	10.1
" "	0.01	No. 7	9.9
" "	0.20	" "	19.8

The difficulty in finding an anti-oxidant that can be added to edible fats and oils lies in the fact that before such a compound can be used, it must be not only fat soluble, but it must be non-toxic, odorless, tasteless, colorless, and on standing or on heating, must not darken in the fat. When a suitable anti-oxidant is found, it will have wide use because the fat spoilage problem is always present.

In the field of mineral oils, where the products are not for human consumption, anti-oxidants are used to prevent deterioration. According to Hyman and Wagner[27], cracked gasolines on standing, especially if they are exposed to light, develop a gum in them. Experiments have shown that gum formation in cracked gasoline is inhibited by the addition of a small amount of a gasoline soluble dye. This may possibly be a partial explanation of why there are so many different colored gasolines for sale at the different filling stations, but more likely these dyes have been added for sales reasons.

There have been patents taken out for the use of anti-oxidants in transformer oils. One of these called "ohmail" has had the rubber anti-oxidant age-rite (phenyl-alpha-napthylamine) added to it. Just how largely anti-oxidants are used in transformer oils, I cannot say, but evidently not very extensively, because in a communication received from one of the large users of transformer oils, they state; "The difficulties encountered, however, in oil is that most of these anti-oxidants volatilize from the oil at elevated temperatures, or else precipitate as a sludge as oxidation proceeds. The remedy, of course, in the latter case is as bad as the original disease."

A research director for a manufacturer of gasoline and oils, including transformer oils, informed me not very long ago that as far as he knew anti-oxidants are not used to any extent in either cracked gasoline or transformer oil.

No discussion of anti-oxidants would be complete without mention of their use in the rubber industry. Although they were first developed for use in the manufacture of rubber tires for automobiles, they are now used in practically all manufactured rubber goods. There is quite a long list of compounds that are used to inhibit the oxidation of rubber. Among these compounds that now may be bought on the general market are: "V.G.B." Acetaldehyde-

(*Turn to Page 277*)

Margarine Regulations Amended to Conform with New Legislation

Bureau of Internal Revenue Publishes Revised Rulings Covering Determination of Color and Definitions of Makers and Dealers

IN ACCORDANCE with the Oleomargarine Act of March 4, 1931, the Bureau of Internal Revenue of the Treasury Department has issued a comprehensive list of amendments to their Regulations No. 9, covering definitions of colored and uncolored oleomargarine, definitions of manufacturers, wholesale and retail dealers in oleomargarine, and description of the standard method to be used in determining the color of oleomargarine for purposes of taxation. The amendments to the Regulations are set forth in Treasury Decision No. 4313, addressed to "Collectors of Internal Revenue and Others Concerned."

The new Oleomargarine Act is quoted as follows:

"An Act to amend the Act entitled 'An Act defining butter, also imposing a tax upon and regulating the manufacture, sale, importation, and exportation of oleomargarine,' approved August 2, 1886, as amended, and for other purposes.

"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the second paragraph of section 3 of the Act entitled 'An Act defining butter, also imposing a tax upon and regulating the manufacture, sale, importation, and exportation of oleomargarine,' approved August 2, 1886, as amended (U. S. C., title 26, sec. 207), is amended to read as follows:

"'And any person that sells, vends, or furnishes oleomargarine for the use and consumption of others, except to his own family table without compensation, who shall add to or mix with such oleomargarine any substance which causes such oleomargarine to be yellow in color, determined as provided in subsection (b) of section 8, shall also be held to be a manufacturer of oleomargarine within the meaning of this Act and subject to the provisions thereof.'

"Sec. 2. Section 8 of such Act of August 2, 1886, as amended (U. S. C., title 26, sec. 546), is amended to read as follows:

"'Sec. 8 (a) Upon oleomargarine which shall be manufactured and sold, or removed for consumption or use, there shall be assessed and collected a tax at the rate of one-fourth of 1 cent per pound, to be paid by the manufacturer thereof; except that such tax shall be at the rate of 10 cents per pound in the case of oleomargarine which is yellow in color.

"'(b) For the purposes of subsection (a) and of section 3, oleomargarine shall be held to be yellow in color when it has a tint or shade containing more than one and six-tenths degrees of yellow, or of yellow and red collectively, but with an excess of yellow over red, measured in the terms of the Lovibond tintometer scale or its equivalent. Such measurements shall be made under regulations prescribed by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, and such regulations shall provide that the measurement shall be applied in such manner and under such conditions as will, in the opinion of the commissioner, insure as nearly as practicable that the result of the measurement will show the color of the oleomargarine under the conditions under which it is customarily offered for sale to the consumer.

"'(c) The tax levied by this section shall be represented by coupon stamps; and the provisions of existing laws governing the engraving, issue, sale, accountability, effacement, and destruction of stamps relating to tobacco and snuff, as far as applicable, are hereby made to apply to stamps provided for by this section.'

"Sec. 3. * * * * *.

"Sec. 4. This Act shall take effect upon the expiration of ninety days after the date of its enactment * *.

"Approved, March 4, 1931."

In accordance with the terms of that law, Regulations No. 9 (Revised August, 1925) are amended by the decision as indicated hereinafter, in part.

Section 29 is amended to read as follows:

"Sec. 29. Definition.—(a) A manufacturer of oleomargarine is one who manufactures oleomargarine for sale, or one who adds to or mixes with oleomargarine any substance which causes such oleomargarine to be yellow in color determined as provided in section 8 of the Act of August 2, 1886, amended, as amended by section 2 of the Act of March 4, 1931, and sells, vends, or furnishes the same for the use and consumption of others, except to his own family table without compensation.

"(b) A private individual may color oleomargarine taxed at the rate of one-fourth of 1 cent per pound without liability as a manufacturer if the oleomargarine is furnished to his own family table without compensation. Those who may be served at such family table include only father, mother, children, servants, and guests who are entertained without charge, and those for whose support the law ordinarily requires the head of a family to provide."

Section 42 is amended to read as follows:

"Sec. 42. Rates of stamp tax on oleomargarine.—

(*Turn to Page 275*)

Secretary-Treasurer's Annual Report

Oil Chemists' Society Shows Healthy Financial Condition During Year 1930-1931, with Slight Membership Gain

THE Annual Report of the Secretary-Treasurer of the American Oil Chemists' Society is summarized below. It will be noted that the Society's financial position is splendid and that the cooperative analyses carried on under the Smalley Foundation are self-sustaining.

The active members of the Society are uniformly zealous in their support of the body, but it is the considered opinion of leading members that the membership should be expanded to greater size. There is no doubt that there are several hundred chemists engaged in the various branches of oil and fat and soap work, who should be members of the Society, but are not. Many of these prospective members would undoubtedly join at once upon the invitation of some member. Every present member is urged to secure at least two new members before the coming Fall Meeting, which will be held in Chicago at the end of October or beginning of November.

SUMMARY OF SECRETARY-TREASURER'S REPORT

1930-1931

Classification	Receipts	Costs	Profit or Loss*
Dues and Journal	$1,884.92	$ 727.50	$1,157.42
Referee Board	135.00	26.39	108.61
Official Fullers' Earth	292.79	42.26	250.53
Color Glasses	250.03	236.47	13.56
Standard Salts	71.91	8.75	63.16
Moisture Dishes	249.25	13.24	236.01
Soap Section	5.78	.50	5.28
Methods of Analysis	147.15	88.87	58.28
Conventions and Meetings	421.50	485.60	64.10*
Smalley Foundation	1,183.90	1,013.78	170.12
Totals:	$4,642.23	$2,643.36	$1,998.87
Year's Cash Account:			
Balance May 1, 1930		$1,933.08	
Interest received during year		256.87	
Profit from operations as above		1,998.87	
Total			4,188.82
Other Disbursements Not Listed Above			
Secretary's Office Salaries and Wages		942.50	
Postage, Stationery, Supplies & Equipment		80.85	
Printing		70.55	
Sundries		60.79	
Total			1,154.69
Balance Cash on hand May 31, 1931			$3,034.13

BALANCE SHEET

Resources:		
Cash		$3,034.13
Bonds		3,700.00
Accounts receivable		127.54
Supplies and materials	Nominal	
Total		6,861.67
Liabilities:		
Accounts payable		57.47
Net Worth:		$6,804.20

The regular seasonal drop occurred in the palm oil shipments from North Sumatra during the first quarter, gross exports from the East Coast amounting to 10,760 metric tons as compared with 15,895 tons for the December quarter of 1930. Shipments for the first quarter of last year totaled 7,882 metric tons.

The decline in price during the past year is evident from the value of exports, which fell from $915,932 in the March quarter, 1930, to $888,612 in the quarter just passed, although the volume of shipments during the latter period was considerably larger.

The share of the United States in the trade during the quarter amounted to 69 per cent, Great Britain's purchases increasing to 14 per cent, and Germany's to 8 per cent of the total.

Exports by Countries of Destination

	Kilograms
Netherlands	825,641
Great Britain	1,563,122
Germany	873,872
France	11,986
United States	7,413,089
Japan	47,532
Other countries	25,073
TOTAL	10,760,315

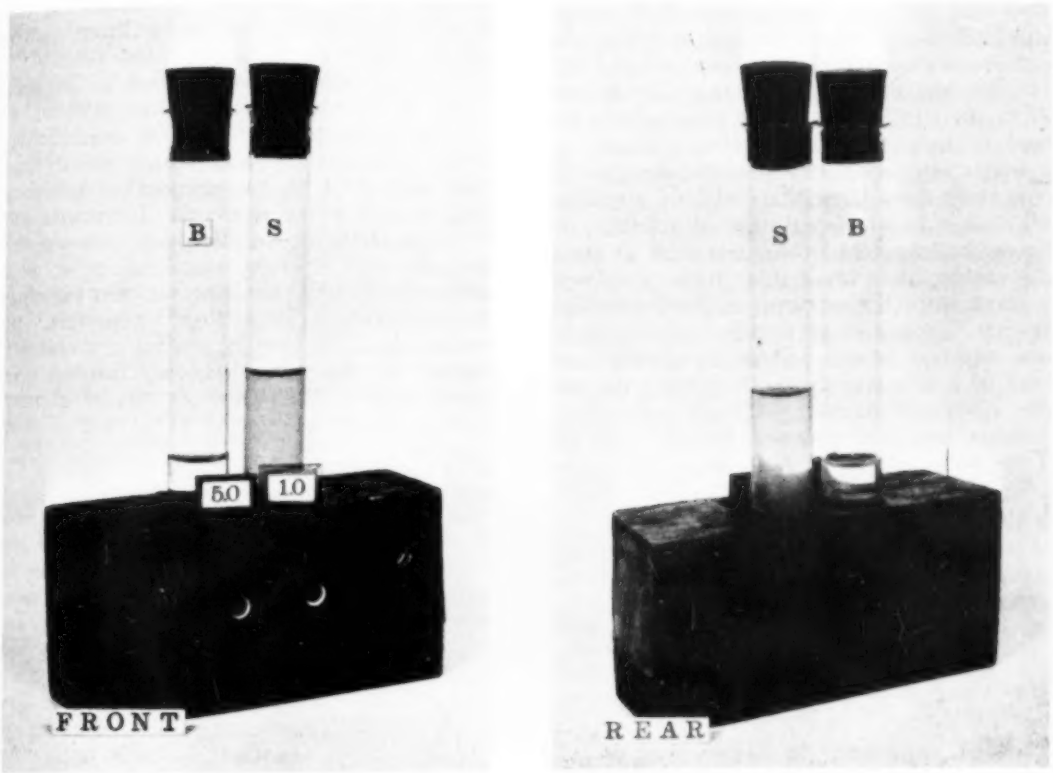
A Norwegian company has been organized to freeze whale meat in floating refrigerating plants. Two vessels have been purchased which are to be sent to the Arctic this summer, the trip being understood to be in the nature of an experiment to determine public acceptance of frozen whale meat. However, it is stated by those behind the venture that inquiries have already been received from several different countries. Vessels have a capacity of 1000 or 1200 tons of frozen and chilled whale meat which will be sold for human consumption and for fox food in Europe.

With the recent opening of a packing plant at Saskatchewan, having a capacity for 150 cattle and 1200 head of swine weekly, the Saskatchewan Cooperative Livestock Producers, Limited, enlarged the scope of their activities by embarking in the packing business. The new plant is thoroughly modern in every respect and includes a chilling and refrigerating system which will enable the new company to export both chilled and frozen meat to Europe as well as live cattle which the producers have been sending to England for sometime past. It is planned to use the Hudson Bay route forwarding shipments via the Port of Churchill, and it is expected the first movement will take place early in September.

Report of Committee on the Kreis Test for Rancidity

Test Not Recommended for Inclusion in Official Methods But Suggestions Offered for Numerical Measurement of Results

By A. S. RICHARDSON, *Chairman*



COOPERATIVE work during the first two years of the committee's existence showed that no two laboratories could be depended upon to obtain the same result when Kreis Tests were made in the usual way and merely reported as positive or negative.

During the last year, two methods of using color standards and reporting Kreis Test on numerical basis were tried. The results were less erratic than without a color standard, but still did not meet the standards of reproducibility which chemists generally have set for approved analytical and testing methods. Because of this difficulty of obtaining reproducible results, and also because of the somewhat uncertain relation of the test to quality of edible fats and fatty oils, it is not recommended that the Kreis Test be added to the official methods of the American Oil Chemists' Society.

To chemists who wish to make use of the Kreis Test, the committee informally offers the advice that the habit of reporting the test as positive or negative should be abandoned, and that some method of measuring the inten-

sity of red color should be used.

One of the committee members has found the Ives tintphotometer suitable for reading Kreis Test colors. It is possible to use paper color standards, although there is considerable difficulty in matching them against colored liquids; the committee members have tried to use, with varying success, the P.R. series in the color chart of indicators in the third edition of Clark's "The Determination of Hydrogen Ions." A more positive color match was obtained in our committee work with the use of Lovibond glasses, in accordance with the method described below.

"5.0 cc. of the fatty oil to be tested is placed in a test tube of 0.66 (±0.02) inch inside diameter and 5.0 cc. of concentrated hydrochloric acid (specific gravity 1.19) added. The tube is closed with a carefully cleaned rubber stopper and shaken vigorously for 30 seconds. 5.0 cc. of 0.1% solution of phloroglucinol in ether is then added and the tube closed and again shaken vigorously for 30 seconds. Alternatively the oil and the reagents are mixed and shaken in a glass stoppered cylinder, and thereafter transferred to a test tube of standard inside diameter. The tube is allowed to stand until the amount of the lower layer separated is sufficient for the color comparisons outlined below. Separations can sometimes be accelerated by gently turning the tube. The color comparison of each tube should be made within 30 minutes after the beginning of the test.

"A blank test is made, repeating the whole of the above procedure, except that the fatty oil is omitted. The reagents should be of such quality that no distinct red color is developed.

"Without removing the ether-oil layer, place the test tube (S) containing the fatty oil in one of the two receptacles provided in a simple block colorimeter as shown in the accompanying illustrations. In the other receptacle place the tube containing the blank reagents (B). Holding the test tubes in an approximately vertical position, observe them through the two small holes of the colorimeter with a small sheet of white paper held in the line of vision in the background. The observer must not look toward any open window or other bright light, but must view the samples by means of reflected light from the white paper.

"The Kreis Test color is matched against Lovibond red glasses placed in series with the blank reagents. To improve the match in hue, Lovibond yellow is used in series with the tube containing the fatty oil, the units of yellow being 1/5 the units of red, plus or minus 0.2. A maximum of two glasses of each color is used."

Occasionally a pink color is obtained simply by shaking together the oil, ether and acid. This is a possible complication which may be taken into account by an additional blank test.

The membership of the committee includes: A. K. Epstein, D. M. Gray, W. D. Hutchins, G. S. Jamieson, W. D. Richardson, S. M. Tolman, H. W. Valteich and A. S. Richardson, *Chairman*.

F. T. C. Against Price Maintenance

Opposition to the passage of legislation permitting resale price maintenance was expressed by the Federal Trade Commission in a report sent to Congress June 22nd. The commission believes that in view of the difficulties of practical administration it would be difficult to provide government regulation of resale price maintenance which would bring relief to makers of trademarked goods without doing injustice to consumers. Interviews with 691 representative manufacturers showed that ten per cent opposed legalization of price maintenance, while six-nine per cent expressed no preference. Less than twenty-nine per cent of the total number, having a larger percentage of the gross income, favored price maintenance. Their average rate of earnings on investment was larger than that of those opposed.

In an investigation of rancidity, it has been observed that when fats containing mono- and di-glycerides are irradiated with ultra-violet light in the presence of air, the free alcohol groups are oxidized to aldehyde groups. Tristearin containing mono- and di-glycerides when irradiated in the presence of atmospheric oxygen gave a negative Kreis test, a positive silver reaction (reduction of ammoniacal silver nitrate) and a negative peroxide test. Synthetically prepared tristearin, free of mono- and di-glycerides, after irradiated olive oil, also triolein, gave positive reactions to the three tests. *Allgem. Ol-Fettztg.* 28, 3-7, 25-9 (1931), *Chem. Abstr.* 25, 3186-7 (1931).

Exports of fish oils from Japan during 1930 amounted to 66,815,000 pounds valued at $2,648,000 as compared with 54,831,000 pounds at $2,445,000, exported during 1929. Exports of rapeseed oil were 24,639,000 pounds and $1,761,000 for the year 1930 and 16,596,000 pounds and $1,454,000 for the year 1929.

Refining Test Committee Report

Year's Work Covered Investigation of Filter Paper, Color Differences and Recovery of Oil from Soapstock

By C. B. CLUFF, *Chairman*

THE Committee's work during the past year consisted mainly of three points: First, quality of filter paper used in filtering refined oil. Second, differences in color between the first and last portions of oil filtered. Third, more detailed instructions regarding cooling and draining foots after remelting.

First, as to quality of filter paper. The following brands of filter paper were tried out by different members and compared with Whatman's No. 40 paper as a standard or some paper equivalent to this as a standard.

Reeve Angel No. 202
Reeve Angel No. 211
Reeve Angel No. 230
Eimer & Amend White
Eaton-Dikeman No. 613
Eaton-Dikeman No. 615
Whitall Tatum
Whatman No. 50
Sargent No. 500

The difference in color reading when filtered through these various papers was, in most cases, so small as to be negligible when compared with our standard. Hence we can only recommend at this time that a good quality paper be specified without definitely excluding any of the commonly used brands.

Second, with regard to color of first and last portions of oil filtered. Experiments were made by reading the color of the first oil through the paper, then a portion after 50 cc. had been filtered, and thirdly the last portion of oil through the paper. The differences were in all cases very small and, in most cases, negligible. Inasmuch as our present rule requires that the first 50 cc. be returned to the filter, we feel that this is a sufficient precaution and that oil filtered after the first 50 cc. will show no measurable change. We therefore do not recommend any change in the existing rule.

Third, with regard to cooling and draining foots on remelting. Our present rule is not specific enough, as was pointed out by Mr. Fash. Some comparative tests show different results, depending on the time of cooling and draining. Hence, for the sake of uniformity, we recommend to melt for 30 minutes, cool 15 minutes or until thoroughly chilled, and then drain 15 minutes.

In addition to the above points, a fourth point was given consideration relating to the time of agitation on slow breaking oils. A sample furnished by Mr. Fash to the Chemists' Committee, representing a very slow breaking oil, was found to give best results with 45 minutes agitation in the cold and 20 minutes hot. While no additional experimental work has been done on this point by the Refining Committee itself, the various members have had sufficient experience with this type of oil so that they confirm the conclusions of the Chemists' Committee on this point.

Recommendations

OUR recommendations are therefore as follows:

First, add to the note at the end of Rule 273, section 5(d) on Refining Procedure, the following paragraph:

> "The filter paper used must be a white paper of good quality so that the filtered oil will have a color substantially equivalent to that filtered thru Whatman's No. 40 paper."

Second, in the same section (d) on Refining Procedure, insert the following, beginning in the seventh line from the bottom, replacing the clause beginning with the words "cool and decant." The new clause will read as follows:

> "Cool in the cold water bath for 15 minutes or until thoroughly chilled. Then decant into a weighed beaker any additional oil thus recovered, and drain for 15 minutes."

Third, in the same section (d) on Refining Procedure, in the ninth line, change the parentheses to read as follows:

> "45 minutes for oils designated as expeller or cold pressed type oil, or slow breaking oil."

The personnel of the committee included R. H. Fash, E. R. Barrow, R. C. Hatter, J. J. Ganucheau and C. B. Cluff, *Chairman*.

Revised Refining Procedure Including Recommendations of the Refining Committee, May, 1931

Rule 273 Section 5 (d)

REFINING Procedure. Place 500 grams of the thoroughly mixed sample of crude oil in a tared refining cup and settle to allow air to escape if necessary. Adjust the temperature of the oil and of the water bath to 20°-24° C., using ice to cool to this temperature if necessary. Agitator must run at the rate of 250 R.P.M. ± 10. Add the proper amount of NaOH solution to the oil as quickly as possible, with the agitator running, and stir exactly fifteen minutes (forty-five minutes for oils designated as "expeller or cold pressed type" oil, or "slow breaking" oil) from the time the lye is added. Then immediately transfer to the 65° C. hot water bath and stir at 70 ± 5 R.P.M. for twelve minutes (twenty minutes for designated slow breaking oils). Temperature of oil must then be 60°-65° C., adjusting the temperature of the water bath, if necessary, within the limits specified, to obtain this final oil temperature. Stop agitator and allow to settle in a water bath at 65° C. for one hour. Cool by setting in a cold water bath at 20°-24° C. 30 minutes and hold at this temperature for at least one hour additional, preferably over night. Weigh the refining cup and contents, and deduct this weight from the total weight at beginning of test to obtain loss by evaporation. Decant the refined oil into a tared refining cup and drain the soap stock for 30 minutes. This oil is to be filtered through white filter paper and used for determination of grade. The first 50 cc. of oil through the filter must be returned to the filter before taking sample for color reading. Weigh the oil and also weigh the soap stock cup with its contents. Melt the soap stock by setting it in a water bath maintained at 75 ± 2° C., without stirring, for 30 minutes; cool in the cold water bath for 15 minutes or until thoroughly chilled. Then decant into a weighed beaker any additional oil thus recovered, and drain for 15 minutes. Weigh this oil separately. Add this weight to the weight of refined oil first obtained, and subtract it from the weight of soap stock first obtained. Repeat the remelting, cooling, and decanting as above, if necessary, until the recovered oil from the last remelting amounts to not over 2.5 grams.

Note:—Any foots floating on the surface of the oil, or decanted with the oil, must be recovered and added to the main body of foots before weighing. This can conveniently be accomplished by decanting the oil through a common tea strainer with a fine mesh screen which will retain the floating foots so that it can be returned to the main body of foots. The filter paper used must be a white paper of good quality so that the filtered oil will have a color substantially equivalent to that filtered thru Whatman's No. 40 paper.

Calculations: Determine refining loss by two methods of calculation, the results of which should check within one-quarter of one per cent. Report the average of the two methods of calculation.

Method No. 1: Weight of Crude Oil minus weight of Refined Oil gives refining loss.

Method No. 2: Weight of Soap Stock plus loss in evaporation, minus weight of NaOH solution used gives refining loss.

Niger Co., Ltd., controlled by Unilever, Ltd., and Nilever, N. Y., report for period of eighteen months ended December 31, 1930, net profit of £583,943. After payment of debenture charges and deducting sums written off for discount and expenses of the debenture interest there was a balance of £51,200 left. This with balance of £67,818 brought forward from previous year makes total of £108,018 carried forward.

In determining the solidifying points of vegetable oils good results were obtained with 6 to 7 grams of oil in a modified Mohr method. Solidification curves of some glycerides change upon adding other fats to them, while some retain original characteristics. *Kiserlet. Kozlemen.* 31,321-31 (1931), *Chem. Abstr.* 25,3188 (1931).

The hexabromide value of soy bean oil is said to be lowered by heating in vacuo to 225° C., the change being increased by the presence of infusorial earth and active nickel. The acid value increases under similar conditions. Elaidic acid is relatively stable toward active nickel on a support, resembling oleic acid in this respcet. *Chem. Weekblad* 27,146-7.

Reduced freight rates on liquid caustic soda in tank cars from Solvay and Syracuse, New York, to numerous destinations in the state of New York have been approved by the New York Public Service Commission. The reductions averaged three cents per cwt. and went into effect early in July.

Notes of the Industry

Edward Flash Retires

Edward Flash, Jr., dean of the cottonseed oil and products brokerage business of New York, has recently retired after more than fifty years of activity in the brokerage and commission business. Mr. Flash entered business with his father in 1879, under the firm name of Edward Flash and Son. In 1887 he became associated with the Southern Cotton Oil Company upon its formation, having complete charge of their sales in New York and abroad. In 1892 he joined the force of the American Cotton Oil Company, leaving that company in 1897 to form the Williams and Flash Company, in partnership with George H. Williams. Upon retirement of Mr. Williams from this partnership in 1909 the business was continued until the present time under the name of The Edward Flash Company. The late William A. Storts was a partner in the business until his death in 1928, since which time it has been conducted by Mr. Flash alone. Mr. Flash will be greatly missed by the members of the trade throughout the country.

Olive Oil Tariff Reduction

President Hoover has approved the report of the Tariff Commision under section 336 of the tariff act of 1930, recommending that the duty provided for in paragraph 53 of that act for olive oil, weighing, with the immediate containers less than 40 pounds be reduced from 9½ to 8 cents per pound on contents and container. The commission in its report makes no findings with respect to a change in the present rate of duty of 6½ cents per pound on bulk olive oil.

A report from Trade Commissioner Carlson at Oslo, states that the production of whale oil through March 27, amounted to about 3,500,000 barrels of which about 2,227,000 were for Norwegian companies.

There have been a number of rumors that Russia expects to ship a considerable amount of linseed during the next year, but the more conservative traders believe that the amount that Russia will put on the market during the next season will not be more than 30 per cent above her exports of last year.

Palm Kernel Separator

A further development in the oil palm industry is exemplified in a new dry separating machine which has been introduced by a well-known British firm. This is claimed as the only machine which effectively separates palm kernels and palm nut shells, obtained by the mechanical cracking of palm nuts, without the use of either clay or brine baths, hitherto favored. The separation of kernels from shells has always presented a difficult problem in this industry, and as by this machine the kernels are delivered dry, no further treatment by washing after separation is required, as was the case by the two previously mentioned methods. In respect of both capital cost and operating charges, the new machine is better than the brine or clay bath installation of equal capacity. Five of these machines are working with complete success in Malaya, and it is expected that many will be installed in other oil palm districts. The separator is based on the fact that the kernels have a greater tendency to roll than the nut shells. The essential features of the machine are the two inclined endless metallic carpets, placed one above the other, onto the upper one of which the mixture of kernels and shells is fed in a thin stream by means of an automatic feeding hopper. The separated product contains no more than 3 per cent. of shell, a lower percentage being achieved under certain favorable conditions. It is not easy to exaggerate the importance of the advantages which should follow this development.

The following table shows exports of fish oils from the Bergen Consular district to the United States during the first quarter of 1931:

	1st Quar. 1930		*1st Quar. 1931*	
	Gallons	Value	Gallons	Value
Cod liver oil, medicinal	387,720	$ 310,699	211,939	$148,487
Cod liver oil, industrial	123,650	55,681	2,500	1,325
Whale oil	6,512,820	2,720,613	1,101,299	679,503
Other fish oils ..	16,500	13,202	—	—

(Report from Consul Smith at Bergen, Norway.)

Wesson Oil and Snowdrift Company, Inc., and subsidiaries report for nine months ended May 31: Net profit after depreciation, federal taxes and other charges, $1,984,042, equal, after preferred dividends, to $1.50 a share on the common stock, compared with $2,237,531, or $1.73 a share in the first three quarters of the preceding fiscal year.

Stocks of crude cottonseed oil on hand in United States as of April 30, 1931 totaled 43,048,435 lbs. as against 61,954,318 lbs. at the same point last year. Stocks of refined oil totaled 462,880,943 lbs. on April 30, 1931, as against 516,752,941 lbs. on the same date last year.

Procter & Gamble Co. pays the announced quarterly dividend of $1.25 per share on common stock, June 15, to holders of record May 25.

Glycera Wax, a new synthetic wax, is now being produced in commercial quantities. It is a light tan colored wax melting at about 140° F. It is odorless, tasteless, and edible. Glycera Wax is more soluble than any of the natural waxes. Turpentine will dissolve more than 12% of its weight to give a permanently clear solution. It is somewhat soluble in alcohol. Glycera Wax is unique in that although it is insoluble in water, it can be dispersed in water very readily without any emulsifying agent. For example if 1 part of Glycera Wax is melted in 10 parts of water and stirred while cooking, it disperses and forms a beautiful white cream when cold. If a larger amount of water is used, a thin milky emulsion results. Both of these dispersions are exceedingly stable. Glycera Wax acts as a softener in rubber and under certain conditions as a plasticizer in lacquers. It blends readily with other waxes and resins.

It has been reported in the London press that offers as high as $70 a ton for substantial unsold quantities of whale oil have been refused by Norwegian whaling companies recently, although previously quantities of oil had sold as low as $57 ton. This has led to the belief that unsold whale oil would be stored rather than being thrown on the market at unfavorable prices. The Bank of Norway has indicated that it may assist in arranging the necessary financial backing and it is thought that the whalers reached an agreement for storage at a recent meeting in Oslo. It is believed that such a development would bring prices as high as $90 ton by the end of the year.

E. A. Staley Mfg. Corp. has recently installed new machinery for the production of soy bean oil which they will use more extensively in manufacturing their products than heretofore.

The annual outing of the Oil Trades Association of New York was held June 16 at Briarcliff, N. Y. Despite unfavorable weather, the day being rainy, the attendance was large, about 200 members and guests, including a delegation from the Oil Trades Association of Philadelphia, being present. Two auto buses carried a large number of the picknickers, but many others made the trip in private cars.

A feature of the outing was a baseball game between the "Petroleum Terrors" and the "Awful Vegetoils," the former winning by a score of 12 to 9. The prizes for this event were silver-backed combs and brushes, the former fitting into the latter. Golf, tennis, swimming, and other sports were indulged in, and the day was voted to have been one of the most enjoyable in the history of the association.

The production of olive oil in Liguria, Italy, during the year 1930-1931 is at present estimated to be little more than one quarter that of the preceding year. The olive crop for the year just finishing, according to preliminary figures which have just been issued, amounted to only approximately 36,038,200 pounds, as compared with 127,540,600 pounds for 1929-1930. Provisional figures for the total production of olive oil from the 1930-1931 yield of olives are given as about 705,165 gallons as compared with a production of 2,711,915 gallons the previous year. Relatively speaking, the Ligurian production is small and it is largely used for home consumption, whereas the olive oil exports are built upon the olive imports from Spain, Tunis, Tripoli, and other sources. (*Report from Vice Consul Huston at Genoa.*)

Material increases in the rates of duty on imports of animal and vegetable oils and fats have been placed in effect by the Mexican government under the terms of a recent presidential decree.

Emery Industries, Inc., Cincinnati, announces changes in the telephone numbers of its New York office, which now will be COrtland 7-1742 and 7-1743.

Gold Dust Corp. has just completed retirement of $15,000,000 of its funded debt. The liquidation took place over a period of eighteen months, during which working capital was not impaired. A saving of $750,000 annually in interest charges will result.

Margarine Regulations

(*From Page 265*)

The tax upon oleomargarine when it has a tint or shade containing more than one and six-tenths degrees of yellow, or of yellow and red collectively, but with an excess of yellow over red, measured in the terms of the Lovibond tintometer scale or its equivalent, is 10 cents per pound, and the tax upon oleomargarine having a tint or shade containing less than one and six-tenths degrees of yellow, or yellow and red collectively, but with an excess of yellow over red, measured in the terms of the Lovibond tintometer scale or its equivalent, is one-fourth cent per pound. Any fractional part of a pound in a package is taxable as a pound. The tax on oleomargarine accrues upon removal from the factory or place where it is made, or upon sale prior to such removal, and is to be paid by the manufacturer thereof by the affixing of stamps before removal. Oleomargarine may be removed from the place of manufacture without the payment of tax for export (Sec. 96) or for use of the United States upon compliance with the provisions of revised Regulations 73 and 34, respectively."

Section 43 is amended to read as follows:

"Sec. 43. Method to be used in determining the degrees of color in oleomargarine.—The sample of oleomargarine to be tested should be spread to a smooth surface in a glazed porcelain tray having an inside depth of 3/16 of an inch. Irregularities on the surface of the oleomargarine should be avoided because they cause the formation of dark shadows. Excessive working of the product should also be avoided because any melted fat on the surface will increase the tint of the oleomargarine. The temperature at which the test is made depends to some extent upon the composition of the oleomargarine but it (temperature) should be high enough to permit the spreading of the oleomargarine in the tray and low enough to prevent melting on the surface. A temperature of 60° F. has been found satisfactory.

"The tray containing the oleomargarine should be placed on a sheet of white filter paper just below the cell end of a monocular tilting type Lovibond tintometer. Fine precipitated calcium sulphate worked to a smooth surface should be put in a similar tray alongside the tray containing the oleomargarine. By tilting the rear of the instrument to an approximate angle of 30° the light from both trays is reflected through the instrument. Standard color glass slides should be placed in slots provided for this purpose until the tint of the calcium sulphate appears to be the same as the tint or shade of the oleomargarine. The numerical color value of the glass slides used is the tint or shade of the oleomargarine.

"The cell end of the tintometer is placed in an 18 inch cubical skeleton frame constructed from one-half inch square wooden material, five sides being covered with sheets of white filter paper, the sixth side being left open for the tintometer. Light from a north window is preferable in taking readings. The use of filtered light through this device makes the color more distinct and also cuts off the possibility of shadows from the outside.

"The adaptability of the eye to perceive variations in color varies considerably with time of observation. It is imperative, therefore, to limit the observation to a fixed time, for which five seconds will be found convenient.

"The porcelain trays used in this test must be of the type generally used with the Lovibond tintometer for matching colors of powders."

Section 82 is amended to read as follows:

"Sec. 82. Packages without stamps or marks to be seized for forfeiture.—All packages of oleomargarine subject to tax found without stamps or marks provided by law and these regulations are liable to seizure for forfeiture; likewise any yellow oleomargarine within the meaning of that term as provided in section 8 of the Act of August 2, 1886, amended, as amended by section 2 of the Act of March 4, 1931, found on the market in packages bearing tax-paid stamps at the rate of one-fourth of 1 cent per pound."

The provisions of this Treasury Decision took effect June 3, 1931, and all rulings in so far as they may be inconsistent therewith were revoked as of that date.

A complete copy of the amendments to Regulations No. 9, as promulgated by the Bureau, may be obtained by anyone concerned upon application to the Commissioner of Internal Revenue for a copy of Treasury Decision No. 4313.

The Archer-Daniels-Midland Company plans to erect one of the largest terminal grain elevators in the northwest, according to a statement of Shreve M. Archer, president, who declared that the company believed more terminal space will be needed to warehouse northwest crops in the future. The proposed new elevator will have a capacity of 7,000,000 bushels and will occupy an entire city block, two small obsolete buildings being razed. Work will start at once and it is expected to be completed September 1.

The New York State Public Service Commission has approved for the Staten Island Rapid Transit Railroad reduced freight rates on cottonseed oil and cottonseed oil foots in bulk (barrels or tank cars) carloads (minimum 30,000 pounds), from Port Ivory to New York Central stations, as follows:—Buffalo, 26½ cents per 100 lbs.; Rochester 26½ cents; Syracuse 25 cents. The new rates became effective June 29.

It is reported in London that Unilever will send its own whaling fleet to the Antartic next season in spite of decision of the greater part of the industry to give up production for the 1931-1932 season. The reason for Unilever's proposed action is said to be the necessity of getting 50,000 tons of fresh oil for edible purposes. It is also believed that Unilever plans to increase its own production to be more independent of other suppliers.

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Anti-Oxidants

(*From Page 264*)

ethylene-diamine, "Stabilite" Diphenyl-ethylene-diamine, "Age-Rite" Phenyl-alpha-naphthylamine, "Neozone" Phenyl-Beta-Naphthylamine, "Antox" Butylaldehyde-aniline.

An interesting observation on the action of anti-oxidants in rubber was reported by P. C. Jones and David Craig a few months ago at the American Chemical Society meeting in Cincinnati. They reported that with anti-oxidants of the secondary aromatic amine type, maximum effectiveness was reached upon the addition of one percent of the anti-oxidant. With anti-oxidants of the aldehyde-type, the limit is not one percent, it may be as high as 6, 7, or even a higher percent of the anti-oxidant. We had noticed in our work that when varying amounts of age-rite and thymol were added to lard, concentrations were reached above which the anti-oxygenic property of these compounds no longer increased with increased amounts of anti-oxidants. On the other hand, large amounts of age-rite, one percent or more, had less anti-oxygenic action than two-tenths percent. The maximum effect was produced when approximately 0.5% of age-rite, or 2% thymol was used.

In conclusion, may I hope that by this more or less general discussion in which I tried to give you something of the history, the theory and the practical value of anti-oxidants, I have stimulated your interest in them as a means of preserving edible fats and oils.

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The Port Gibson Oil Works, of Port Gibson, Mississippi, has filed a complaint with the Interstate Commerce Commission attacking freight rates on cottonseed from Louisiana and Arkansas points to Port Gibson. The complaint declares that the rates are higher, distance considered, than the rates prevailing in Louisiana and Arkansas.

The Matson liner *Sonoma* docked recently at San Francisco with fire in cargo holds containing copra. The vessel had just completed a trip to the Antipodes, returning via Suva and Pago Pago, where a good cargo of copra was loaded. The blaze is said to have caused several thousand dollars damage before it was extinguished.

Bureau of Entomology of the U. S. Department of Agriculture has announced the appointment of R. W. Harned as leader of its division of cotton insect investigations, effective June 20. He succeeds B. R. Coad, resigned. Mr. Harned is head of the Mississippi State plant board, and since 1908 has been professor of Zoology and entomology at Mississippi A. & M. College.

Mexican Tariff Increases

A Mexican Presidential decree, now effective, materially increases the rates of import duty on various commodities including pork lard and lard compounds, oleomargarine, animal and vegetable oils and fats, and certain oil seeds. The new rates of duty in Mexican pesos are as follows, old rates also being shown:

Food Products	*New Rate*	*Old Rate*
Pork lard in tank cars (per net kilo)	0.20	0.10
Pork lard in other containers (gross kilo)	0.30	0.15
Lard compounds and substitutes (gross kilo)	0.40	0.20
Oleomargarine (per legal kilo)	0.80	0.60
Animal and Vegetable Oils and Fats		
Cottonseed and sesame seed in tank cars or tank vessels (per net kilo)	0.20	0.10
Cottonseed and sesame seed weighing with the immediate container more than 50 kilos (per gross kilo)	0.25	0.12
Animal and vegetable oils, not specified, in tank cars or tank vessels (per net kilo)	0.20	0.10
Animal and vegetable oils, not specified, weighing with the immediate container up to 50 kilos (per gross kilo)	0.40	0.30
Animal and vegetable oils, not specified, weighing with the immediate container more than 50 kilos (per gross kilo)	0.25	0.12
Edible vegetable fats, solid at a temperature of 20 degrees Centigrade, substitutes for lard compounds (per gross kilo)	0.40	0.20
Animal and vegetable fats and greases not specified, weighing with the immediate container up to 50 kilos (gross kilo)	0.40	0.20
Animal and vegetable fats and greases not specified, weighing with the immediate container more than 50 kilos (gross kilo)	0.25	0.10
Cottonseed (per gross kilo)	0.03	0.008
Sesame Seed (per gross kilo)	0.10	0.04

OIL & FAT INDUSTRIES

The Editor's Page

Truth Out of Iowa

LOUIS H. COOK, *Chairman,* Iowa State Board of Assessment and Review, writing in the leading article for the August issue of "The Country Gentleman," outlines the possibilities and potentialities of "Trade Wars Among the States," which he declares will be the inevitable results of the present flood of selective taxation laws directed by various states (chiefly in the Midwest) against products originating in other states.

Quoting a report made in 1930 by a Joint Legislative Committee on Taxation and the State Board of Assessment and Review of the State of Iowa, Chairman Cook says: "Oleomargarine is a product manufactured by nonresidents of this state out of commodities of *doubtful* food value. The use of this substitute for butter limits the use of and lowers the market value of butter produced by the dairy interests of this state." (The italics are ours.) Continuing in his article in "The Country Gentleman," Chairman Cook says; "Sounds just a wee bit prejudiced, doesn't it? . . . an oleo tax, now enacted into law, is one of the recommendations made by that group of men, which included nine Iowans who were supposed to be qualified and representative. I was one of those nine men. That committee was typical. It was looking out for the interests of the state of Iowa, and was neither more nor less selfish than a similar committee made up of high-class citizens of any state would be under like conditions."

Chairman Cook admits his prejudice, but overlooks his ignorance and that of his fellow committeemen. That any body of nine men claiming to be "high-class" citizens of the United States, could, in 1930, be so unenlightened as to make the bald statement that margarine is manufactured out of commodities of "doubtful food value," is a sad reflection on the education, not only of the nine, but of the citizens of the state they represent. Farther along in his article Chairman Cook says: "It would appear that, aside from the natural check-rein of self-interest, which will prevent states from biting off their own noses to spite their faces, Congress and the Supreme Court of the United States will ultimately have to determine the permanent policy."

We cannot put much hope of relief in Congress, which is inclined to think and act in a manner similar to that of state legislatures, but it is likely that the Supreme Court will rule against the erection by states of barriers to the products of other states. In the meantime, we hope that the teaching of biochemistry in our great midwest universities will some day arrive at the point of inclusion, within the category of healthful foods, of some products which are not produced by the agricultural interests of each university's home state.

■

Setting the House in Order

ELSEWHERE in this issue we present the Preliminary Report of the Bureau of the Census, giving figures on the cottonseed crush and cottonseed products manufacture as of June 30th, 1931, with comparisons for the same date in 1930.

The outstanding fact to be read from the figures as made public by the Bureau of the Census shows a marked reduction in stocks of oil and of cottonseed during the period just ended. Stocks of crude oil were 38 percent lower, and stocks of cottonseed at the mills were 57 percent lower, than at the corresponding time in 1930.

It is apparent that the cottonseed crushing industry is preparing to avail itself of the information adduced by the recent economic survey of the industry by the National Cottonseed Products Association. That the mills should continue to compete with each other for the farmers' seed at prices which would not permit any profit on the milling operations, in the face of the facts as to production costs and profits shown by that survey, is unthinkable.

If each cottonseed oil mill will adhere rigidly to the policy of paying no more for seed at any given time than will permit a reasonable profit on the basis of current prices for the manufactured products, some mills may be forced to remain idle, but that will be surely preferable, even for the idle mills, than persistent operations which show a daily loss of many dollars.

The net decrease in all available vegetable oils in this country, including cottonseed oil, was 372 million pounds, but in spite of this decrease of availables, total stocks at the end of 1931 were 31 million pounds greater than at the end of 1930, indicating a marked falling off in consumption. Linseed oil was responsible for the greatest decrease in consumption, therefore the cottonseed oil producer can enter the new season with the feeling that anything like a normal demand for edible oils should enable him to find a market for his production.

■

A. O. C. S. to Meet in Chicago

FINAL determination of the dates for the Fall Meeting of The American Oil Chemists' Society has been reached. The Meeting will be held in the Florentine Room of the Congress Hotel in Chicago on Thursday and Friday, October 29 and 30.

W. H. Irwin, Chairman of the Chicago Committee on Arrangements announces that an interesting program is in course of preparation. There will be a number of special entertainment features, for members and for ladies who attend the Meeting. The bowling tournament which was such a success at the last Fall Meeting will be repeated this year.

A number of interesting scientific and technical papers have already been promised for presentation at the Meeting, and other members desiring to present papers are urged to communicate promptly with President Richardson or Chairman Irwin, for reservation of time on the program.

The Congress Hotel has made very attractive rates for the convention, and arrangements have been made to send cards to the Society's members, entitling them to the low rates, under which a single room with bath may be had for as low as $3.00, or a double room for $5.00 per day, European Plan.

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Mayonnaise Research Assistant

John B. Glassford, chairman of the Committee on Mayonnaise Fellowship, announces the appointment of Donald H. Wheeler as assistant to L. B. Kilgore, Research Fellow of the Association.

Mr. Wheeler was graduated from Oberlin College in 1927. From then until 1929 he was employed in the chemistry research department of the United States Industrial Alcohol Company, and was located in Baltimore. For the past two years he has been conducting research on methods of analysis and methods of preparation for a Master of Science Degree, which degree he received this year.

Margarine Suits

Two petitions on behalf of the Government, through the internal revenue collectors in different districts of Florida, have been filed in the Supreme Court of the United States asking a review of decisions of the Circuit Court of Appeals for the fifth circuit, in cases involving the question whether a product of the Standard Nut Margarine Co. of Florida is taxable as oleomargarine.

The Florida corporation engaged in the manufacture and sale of a product known as Southern Nut Product, a mixture or compound of coconut oil, peanut oil, salt water and coloring matter. The Commissioner of Internal Revenue decided that this compound was taxable as colored oleomargarine and assessed a tax of $5,000 on 50,000 pounds of the compound estimated to have been produced during the month of January, 1929.

Suits were brought by the corporation to restrain the collection of the tax. The complaint alleged that the product is not oleomargarine as that term is defined in the statute and that its taxation is not authorized by the Oleomargarine Act. The Commissioner of Internal Revenue alleged that the product is artificially colored oleomargarine and is taxable pursuant to the law.

■

Consul G. R. Willson, at Lagos, Nigeria, has informed the Bureau of Foreign Commerce that a firm of exporters in Nigeria is desirous of forming a connection with importers of palm oil in the United States. Anyone interested can obtain further particulars by addressing the Foodstuffs Division.

■

One of the Cuban vegetable compound factories is now contemplating the installation of a refining plant for vegetable oils, and has been encouraging the planting of sesame seed by Cuban farmers. The above are the first attempts in Cuba to produce oil seeds in commercial quantities.

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The People's Cotton Oil Co., of Selma, Alabama, has been purchased by Swift and Company. The plant at Selma will be enlarged and improved to make it a modern link in Swift's chain of cottonseed oil mills.

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A cottonseed oil mill and three cotton gins of the J. G. Boswell Company, Corcoran, Calif., were destroyed by fire July 10. A blown fuse in the mill was given as the cause. The loss was not estimated, but it will be high.

Susceptibility of Fats to Oxidative Rancidity†

A Method of Measuring the Rate of Formation of Oxidative Decomposition Products in Fats and Oils

By D. P. Grettie and R. C. Newton*

THE intense research which is being applied to shortening material by both the producer and the user has emphasized the need of better methods for testing its various functional qualities. The susceptibility of fat to oxidative rancidity is one of the most important factors in evaluating a shortening for many uses. There is, therefore, need of a quick reliable method for determining the relative susceptibility of various fats to rancidity.

Such a method should give quickly, an accurate indication of the stability of a fat under ordinary conditions. Any method in which rancidity is developed rapidly requires the application of rigorous conditions, hence it is to be expected that any such method will not give absolute comparisons between different kinds of fats for all conditions. It is possible, however, that such a method may give reliable comparisons between samples of fat from the same general source, and some indication of the relative keeping qualities of samples from different sources if the method provides an accurate means of measuring the rancidity developed.

Several accelerated rancidity tests have been proposed. The best known of these are:

1. The oxygen absorption method.
2. The Bailey method.
3. Incubation followed by organoleptic inspection.

The oxygen[1] absorption test is especially subject to criticism in comparing fats from different sources, because the rate of oxygen absorption is not always comparable with the rate at which volatile oxidative decomposition products are formed. It is these oxidative decomposition products which render the fat unusable. For example, semi-drying oils consume large amounts of oxygen in the formation of gums, and condensation products with very little formation of the undesirable odor of rancidity.

The Bailey[2] method makes use of Schiff's reagent to measure the amount of volatile aldehydes, produced under controlled conditions. The objection to this method lies in the fact that the Schiff's reagent, in which the volatile products of rancidity are condensed, is very unstable and difficult to maintain in a colorless condition. There is some difficulty also in measuring accurately the amount of color developed.

Probably the simplest and most reliable method heretofore developed is the incubation test in which the fat is kept in an oven at an elevated temperature and inspected for odor and flavor at regular intervals. In this test rancidity usually develops at some time between two and forty days, depending upon the stability of the particular sample under test. There are, however, two objections to this method for ordinary use.

1. The time required to get results is entirely too long for many practical purposes.
2. The criterion is that of odor and taste, and therefore subject to a very decided personal element of possible error in judging the point of inception of rancidity.

The Kreis[3] test may be used as an auxiliary indication of the amount of rancidity developed at various stages of the incubation period. The Kreis test fails completely, however, when fats from different sources are compared.

The method herein described was designed to measure the relative rate of formation of volatile oxidative decomposition products of fats held under a specified set of conditions. It is

† Presented before American Oil Chemists' Society.

* Contribution from Swift & Company's Research Laboratory.

[1] G. R. Greenbank and G. E. Holm, Ind. and Eng. Chem. *17*, 625 (1925).

[2] H. S. Bailey and H. C. Ebert, Cotton Oil Press I, No. 8, P 35.

[3] Robert Kerr, Ind. and Eng. Chem. *10*, 471 (1918).

Apparatus for the
MEASUREMENT OF VOLATILE OXIDATION PRODUCTS OF FATS AND OILS

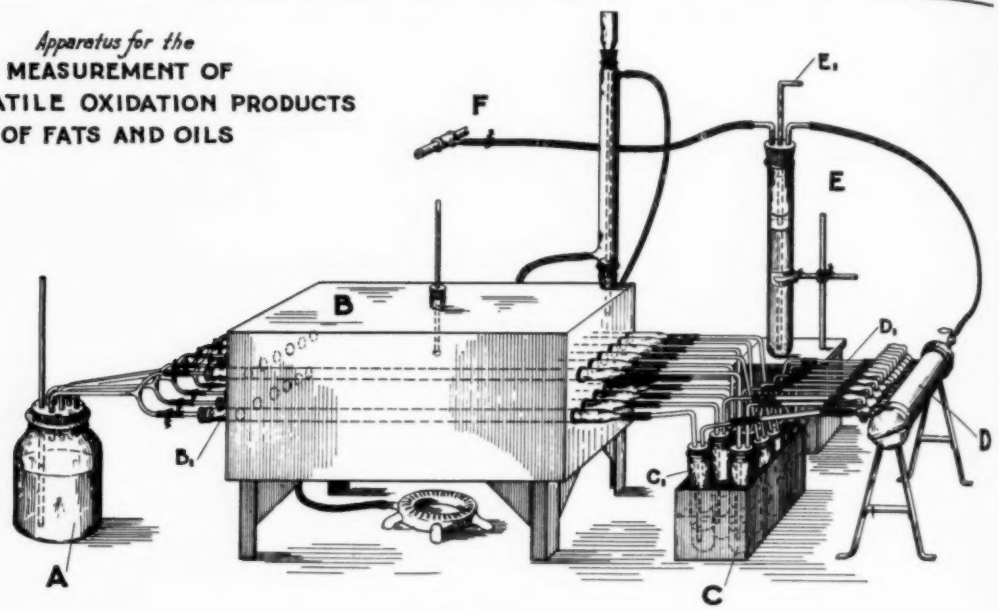


Figure 1

a modification of the methods of Bailey and of Issoglio. Since all of the volatile products probably contribute to the odor given off by a rancid fat, the measure of these products should be also a measure of the degree of spoilage of the fat in question. This measurement is performed by titrating, against acid permanganate, the products carried away in a given time interval by a constant stream of air passing over the fat. The fat being dispersed on filter paper and maintained at a specified elevated temperature. The stream of air is drawn over the fat and then through a standard solution of acid permanganate, which is maintained at a temperature of 25° C. to condense any decomposition product picked up from the fat. This solution is then titrated against oxalic acid to determine how much has been used by the decomposition products condensed in it. The titration of the distillation products of rancid fats with permanganate was formerly proposed by Issoglio[4].

Description of Apparatus

FIGURE 1. A—Wash bottle containing acid permanganate solution through which the air is drawn before passing over the fat. This washing operation is for the purpose of removing from the air any impurities which might catalyze the oxidation of the fat. Individual tubes lead from this wash bottle to the glass tubes (B_1) where they are connected by tight-fitting rubber stoppers. Means must be provided in these connections for closing off any tube not in use, or which is temporarily open for the replacement of condensation tubes.

B—The tubular oven is a metal box 19½" x 14" x 8" with two openings in the top and containing a number of tubular holes extending full length from end to end. These tubes are also made of metal and soldered water-tight throughout. The openings in the top are to accommodate a thermometer and reflux condenser. The oven is filled with water and kept at boiling temperature throughout the test. B_1 is a glass tube containing a pleated filter paper upon which the weighed fat is dispersed. This tube is 20 mm., inside diameter except for a few centimeters at one end where it has been constricted to a diameter of about 4 mm. so that it may be connected to the glass tube (C_1) by rubber connection. This tube (B_1) extends entirely through the metal tubular oven and the filter paper is so placed that it is near the center of the oven.

C—Water Bath, maintaining equalized temperature of permanganate solution in the condensation tube. A temperature of 25° to 30° C. has been found satisfactory for this bath.

[4] G. Issoglio, Ann. Chim. Applica *1916* 1-18.

C_1 is a large test tube (diameter 1 inch) containing 10 cc. of 0.01 N potassium permanganate solution made acid with 1 cc. of approximately 5 N sulphuric acid. Air is allowed to bubble through this solution after passing over the fat, so that any volatile material picked up from the fat is condensed in this tube.

D—A manifolding device consisting of a 2-inch iron pipe inset with a number of openings connected with petcocks. This device serves for the purpose of connecting a number of test samples with precisely the same vacuum. D_1 is a capillary glass tube which throttles the flow of air and thereby allows a very accurate control of the volume of air passing over any test sample. This tube is connected between the manifolding vacuum device and the condensation tube. By using capillaries of the same bore and the same length, it is a relatively simple matter to obtain the same volume of air over each of a number of samples. A capillary tube of ½ mm. bore and 10 cm. length gives satisfactory results.

E—A device for maintaining constant vacuum. The depth of the tube E_1 (which is open to the air) below the surface of water controls the pressure difference between the manifolding device and the atmosphere. We have regulated this depth to 29.5 c.m. which when we deduct for total of 13.5 c.m. column in wash bottle and condensation tube is just sufficient to produce 1 c.c./sec. air flow in our apparatus.

F—Vacuum line with screw clamp for regulating the flow of air so that the incoming air at E_1 is steady and not too vigorous.

Procedure

THE tube B_1 is removed and properly cleaned with acid dichromate solution, after which it is thoroughly dried. A piece of filter paper 5 x 30 centimeters is creased three times lengthwise to form pleats of four layers. This paper is placed across a clean watch glass on a balance and two grams of the sample of fat weighed onto it. The fat should be distributed so that when melted it will be soaked up by the entire paper. The paper is then very carefully placed in the glass tube B_1 about 8 inches from the end, and thence into the oven, which is maintained at 100° C.

The condensing tube containing 10 cc. of 0.01 N potassium permanganate solution to which has been added 1 cc. of dilute sulfuric acid is set into the water bath (C) and connected into the system. When all connections are adjusted, the stream of air (1 cc. per second) is started through the tube by opening the screw clamp leading to the vacuum line. At the end of 20 minutes the condensing tube C_1 is replaced by a like one and the contents of the first titrated as follows:

11 cc. of 0.01 N oxalic acid are added and the tube heated in a boiling water bath until completely decolorized. It is then titrated, while still hot, to the appearance of a faint pink, with standard permanganate solution. These replacements and titrations are made at regular 20 minute intervals until the rate of decomposition in the fat is sufficient to use up 1 cc. of the 0.01 N permanganate solution in one 20-minute period. For samples of exceptional stability, the replacements are made hourly and the criterion taken as the time required to produce a rate of decomposition equal to 1 cc. of 0.01 N permanganate solution per hour.

The above figures were taken arbitrarily after it was found by inspecting a large number of samples that the odor of rancidity developed at about this point.

Precautions

DUE to the extreme rapidity with which samples of fat are forced to become rancid under this test, there are some variables which need very careful control in order to assure accurate results.

In the following tables are given some results showing titrations for duplicate tubes containing portions of the same sample of fat. The values represent the cubic centimeters of 0.01 N permanganate solution reduced between the time intervals indicated.

Sample	20′	40′	60′	80′	100′	120′	140′	160′	180′	200′		
A	.0 cc	0.1 cc	0.3 cc	0.3 cc	1.2 cc	1.6 cc						
	0.1 cc	0.1 cc	0.3 cc	0.6 cc	1.1 cc	1.5 cc						
	1 hr.	2 hr.	3 hr.	4 hr.	5 hr.	6 hr.	0.5 cc	0.6 cc	0.8 cc	1.4 cc		
B	0.2 cc	0.2 cc	0.2 cc	0.2 cc	0.3 cc	0.5 cc	0.4 cc	0.6 cc	0.9 cc	1.5 cc		
(oil)	0.2 cc	0.2 cc	0.3 cc	0.3 cc	0.4 cc	0.4 cc	7 hr.	8 hr.	9 hr.	10 hr.	11 hr.	12 hr.
C	0.0 cc	0.1 cc	0.0 cc	0.1 cc	0.2 cc	0.6 cc	0.9 cc	1.5 cc				
	0.2 cc	0.1 cc	0.1 cc	0.1 cc	0.2 cc	0.4 cc	0.9 cc	1.6 cc				
D	0.2 cc	0.1 cc	0.1 cc	0.0 cc	0.3 cc	0.4 cc	0.5 cc	1.2 cc	2.0 cc			
	0.3 cc	0.0 cc	0.0 cc	0.0 cc	0.2 cc	0.5 cc	0.9 cc	1.1 cc	1.8 cc			

1. *Cleaning of reaction tubes.* The reaction tube which contains the fat dispersed on filter paper, accumulates during the course of a test, small quantities of rancid fat closely absorbed to its surface. If this trace of fat is not completely removed it accelerates the course of rancidity of the next succeeding sample to such an extent that results are not at all reliable. These tubes can be cleaned sufficiently to give reproducible results, however, by filling and allowing to stand over night with strong acid bichromate cleaning solution. The last trace of cleaning solution must be removed completely with distilled water.

2. *The filter paper* has such intimate contact with the fat over a relatively large surface that the slightest trace of impurity leads to inaccurate results. It is necessary, therefore, to crease several sheets of filter paper at one time and discard the outside ones which have come in contact with the fingers. The type of filter paper used should be the same at all times, and should be the purest grade obtainable. It is important that extreme care be used to prevent contamination in handling the paper after it is creased while weighing the sample of fat and inserting the paper in the reaction tube.

3. The rate of flow of air over the sample of fat has two opposite effects on the rate of the development of rancidity. It furnishes agitation of the air which keeps uniform concentration of oxygen at the reacting interface. This also carries away a portion of the volatile oxidation products which are known to have an accelerating effect on the course of rancidity if not removed. Both of these factors may be standardized, however, by fixing the rate of flow of air and also the contact of this flowing air with the filter paper surface. It has been found that if two of the folds in the creased filter paper become adhered at one end or the flat surface of the filter paper is pressed against the glass so that the air does not have free circulation around all sides of the filter paper, the results will not check.

4. There is a very slight reduction in pressure in the reaction tube, due to the column of permanganate solution through which the air is washed. It is essential that all of the air be washed through the same bottle, so that there will be no difference in the air furnished the various tubes. For this reason it is essential to have a pinch clamp between the permanganate wash bottle and the reaction tube, so that any tube may be shut off while it is temporarily disconnected or out of use. If it is not shut off when disconnected, the air will be drawn through this tube in the reverse direction and then through the other reaction tubes, thus contaminating them all.

5. It is necessary to regulate the flow of air through the reaction tubes for reasons previously mentioned. If the diameter of the capillary tube and the difference in pressure are known, the length of the capillary can be calculated to give any desired rate of flow. Poiseuille's formula,

$$L = \frac{n\ r^4\ t}{8\ N\ V}$$

in which L is length of capillary tube, V is the volume of air, N is the viscosity of air (.000184), R is the radius of capillary tube. T the time in seconds, and P is the pressure in millimeters of mercury. The pressure difference can be obtained by measuring the column of water in the pressure regulating device, and deducting that in the wash bottle and condensation tube. This can be regulated to any desired amount.

6. It sometimes happens that water is vaporized from the permanganate condensing tubes and recondenses in the capillary tubes, thus temporarily closing them. When this happens the air will cease to bubble through the condensation tube so that it is readily noted. In this case the capillary tube should be removed and washed out with alcohol. If it has been stopped only a few minutes, there will be no noticeable difference in the result.

■

A new type of evaporator unit for refrigeration work, recently introduced, employs a recently developed, light rustless alloy of aluminum known as "aluminol." The aluminol units may be used either for direct expansion or brine circulation systems. The use of aluminol instead of the usual cast iron or steel pipe coils is said to offer several important advantages. The weight of the aluminol unit is less than one quarter that of a cast iron or steel unit of equal radiating surface; besides which, the higher heat-transfer efficiency of the new alloy permits lower cost per square foot of surface and a more compact evaporator assembly which assures more B. T. U. transfer per cubic foot of installation space than is possible with other types of radiation. Being rustless, aluminol needs no metal coating, galvanizing, etc. to protect it against moisture.

Oilseeds Industries in the British Empire

Review of Recent Progress in Development of Production, Refining and Utilization of Fats throughout the Empire

THE British seed-crushing, vegetable oil refining, margarine, soap-making and allied industries, though sufferers during the past year or two in common with other basic industries, have been sufferers only of a minor character. One noteworthy reason for this is that the trade and commerce in oilseed cake, technical and edible fatty oils, margarine, soap and candles are in commodities which are in the nature of necessities to an increasing part of the world's population.

The British Empire furnishes rather more than half the world supplies of oilseeds, oil-bearing nuts and kernels, produces considerable supplies of such animal fats as tallow, and plays a controlling influence in the whale oil industry, providing not insignificant amounts of fish oils. Every oilseed of importance, with the exception of the olive, soybean, hempseed, and sunflower seed, is grown in some part of the Empire, and every fatty oil is produced within Imperial territory except such oils as corn oil and tung oil.

Research Stations

IN RECENT years the attempt has been made not only to cultivate within the borders of the Empire oilseeds hitherto not indigenous, but to extend to other parts of the Empire oil-bearing crops already grown with success somewhere within its confines. In connection with this work, there has grown up a chain of Imperial agricultural research stations, which during the past year have arranged to work in close cooperation with the central Botanical Gardens at Kew, London. Among the endeavors of these stations may be cited efforts to acclimatize the Manchurian soybean to Northern India, South Africa, Australia and Great Britain.

In 1917 the Imperial Institute sponsored the first attempts to cultivate the tung tree within the Empire. Spurred by the success of the American Tung Oil Corporation in the cultivation of the tree in Florida, the Research Association of British Paint, Colour and Varnish Manufacturers has distributed quantities of seed to various parts of the British Empire, and reports from Central India, Madras and Assam appear very promising. Last year the New Zealand Tung Oil Corporation was formed and plans to devote 40,000 acres to the cultivation of tung oil trees are being formulated. The scheme is an ambitious one, including the provisions of seed-crushing and refining plant.

Considerable headway has been made in recent years in the cultivation of the peanut in Australia and experiments are also taking place in Nigeria and Southern Rhodesia. Experimental crops of sunflower have been grown in New Zealand, Australia, Rhodesia and other parts of the Empire. Though West Africa continues to furnish the bulk of the world's needs of palm oil and palm kernels, the commercial exploitations of the oil palm continues to make headway, not only in the Netherlands East Indies, where plantations were first established, but in British Malaya also.

Margarine Industry

THE reason of the relatively greater importance in commerce today of copra, palm kernels, peanuts and other rich oil-bearing seeds is the growth of the margarine industry, which received a great stimulus during the war. During the past year 300,000 tons of margarine were manufactured in Great Britain. This quantity is one-fourth of the world supply, making Britain rank second only to Germany in margarine production. The application of modern hydrogenation methods, particularly a continuous method of recent development, has worked wonders in the refining and preparation of various fats for margarine uses.

Whale Oil

THE great developments which have taken place during the past few years in the production of whale oil have resulted in the

introduction of a serious competitor to vegetable oils, since the great bulk of the whale oil can be used in the soap-making industry and an increasing amount is used in the manufacture of margarine, compound lards and confectionery fats.

As evidence of the improved technique in the production of whale oil, it may be mentioned that today the average yield of oil is 75 barrels from each whale, as against a yield of only 25 barrels fifteen years ago. Furthermore fifteen years ago only 60% of the cargo consisted of Number 1 oil, whereas today as much as 95% of some cargoes is of grade 0/1, which commands the highest price. *The Manchester Guardian Commercial, courtesy of U. S. Trade Commissioner Messenger at London.*

■

Lovibond Red Glasses

PRESIDENT RICHARDSON of the American Oil Chemists' Society has received the following communication from the Director of the Bureau of Standards, in reference to the calibration of red Lovibond glasses:

July 21, 1931

Mr. A. S. Richardson, *President,*
American Oil Chemists' Society,
% Procter and Gamble,
Ivorydale, Ohio.

Subject: Calibration of Red Lovibond Glasses.

Dear Sir:

In view of the fact that there has recently arisen a demand for the calibration of red Lovibond glasses of very low numerals (less than unity) to be used in combination with yellow glasses of very low numerals (about 0.8 to about 1.6), it seems expedient to emphasize that all of the values which have been certified by this Bureau for red glasses since January 1, 1928 have been those "effective when the red glasses are used in combination with 35-yellow" (as has been stated in the reports on calibration of glasses). It should not be assumed that these values are the correct ones to be used when the red glasses are used alone or in combination with only very small amounts of yellow. It may be assumed that they are valid for use of red glasses in combination with 20-yellow, and perhaps lesser amounts; but it should not be assumed that they may be accepted as the correct values when the red glasses are being used with yellow amounting to only about 1 or 2 or less.

If red glasses are to be used alone or in combination with only very small amounts of yellow, they should be calibrated with this specific purpose in view, although we cannot say definitely in advance just what difference may develop between calibrations for use with small amounts of yellow and calibrations for use with large amounts of yellow.

We are planning a standardization of the red glasses alone without respect to their use in combination with 35-yellow but are not yet prepared to accept glasses for test in these circumstances.

Respectfully,
George K. Burgess, *Director.*

Frank Hemingway

Frank Hemingway, president of Robinson, Butler, Hemingway Co., Bound Brook, N. J., and for many years a manufacturer of disinfectants, insecticides, and allied coal-tar products, died June 27 at the Montague Hospital, New York, after a protracted illness. Born in England on Christmas Day, 1876, he came to the United States in 1897. He was at first in the margarine business, but in 1913 established a plant at Bound Brook to manufacture coal-tar products. He later became associated with the Sherwin-Williams Co. in Cleveland, with a world-wide reputation as an authority on coal-tar products. He organized his present company in 1925.

Mr. Hemingway was a member of many technical societies and clubs. He is survived by his mother, Mrs. Catherine Hemingway, two sons, Henry and Richard, and one daughter, Miss Virginia Hemingway.

■

A cable from Commercial Attache Cunningham at Lima, reports that with the protection afforded by the Government local producers of cottonseed oil are gradually replacing lard with their products. The duty on imported cottonseed oil is about $0.06 a pound while that on lard is about $0.035 a pound.

■

Only two factories in Sweden are engaged in the production of vegetable oils for the soap and margarine industries. These are: the Nya Margarin Aktiebolaget Svea at Kalmar and the Reymersholms Gamla Industri Aktiebolag of Helsingborg, whose factory is located at Karlsham. The first of these firms, originally established in 1905 for the manufacture of margarine, added a few years ago a plant for the production of peanut oil, coconut oil, and palm kernel oil, using a portion of the production in its own margarine plant, and selling the remainder to other manufacturers. The second named firm, which owns a variety of industries in the metals and heavy chemicals lines, has among other undertaking the factory at Karlsham, established in 1916, and producing crude and refined peanut oil, cottonseed oil, coconut oil, and soya bean oil.

Whereas until comparatively recently prices of vegetable oils were such as to give a safe margin of profit to these two factories, quotations have recently dropped to such an extent that a serious depression exists in the industry. This decline has been especially marked during the past six months, in coconut oil, peanut oil, soya bean oil, and cottonseed oil.

Glycerin Analysis Committee Report*

Cooperative Investigation of Alleged Disagreement Between Acetin, Bichromate, and Specific Gravity Methods

By J. T. R. ANDREWS, *Chairman*

THE work of the Glycerin Analysis Committee this year has been confined to an investigation of the alleged disagreement between the acetin, bichromate and specific gravity methods of determining the apparent glycerol content of distilled glycerins, using the moisture determination as a check.

Preparation of Samples: "A" was a double-distilled C. P. or U. S. P. Glycerin. "B" consisted of "A" purified by a laboratory fractional distillation through a 48″ Vigreux column under 5-7 mm. pressure. The first and last portions of distillate (about one-third each) were rejected and the middle portion, which exhibited a very constant boiling point, was diluted with water to about 95% glycerol content before distribution. "C" was a double-distilled C. P. or U. S. Glycerin from a different producer. "D" was a single-distilled, carbon-bleached glycerin. All of the above glycerins presumably were made by the distillation of salt crudes.

Cooperative Analyses: Eleven laboratories determined apparent glycerol content by the acetin method; ten by the bichromate method. The specific gravity test was made by eleven laboratories and moisture determination by eight. In tabulating these figures it was thought advisable to exclude certain doubtful analyses from consideration in arriving at an "accepted value." Justification for such a procedure is found in Farnsworth's "Quantitative Analysis," p. 26. This author recommends rejection of any result whose deviation from the average, obtained by excluding the questionable value, exceeds four times the mean deviation from this average. Calculations of the probable errors of the accepted value and individual determinations were made by use of the formulæ given on pp. 523-24 of Mellor's "Higher Mathematics." The probable error of the accepted mean varies inversely as the square root of the number of cooperating laboratories and is a guide as to the reliance that may be placed upon the accepted value. The probable error of the individual determination is a measure of the reproducibility of the analytical method in the hands of different analysts and is of value as such. This error is not affected by increasing the number of analytical results.

Specific Gravity. Apparent specific gravity at 15°, 15.5°, 20° or 25° C. in terms of water at the same temperature was determined by eleven laboratories. All who described the method used employed a 10 cc., 25 cc. or 50 cc. pyknométer generally of the Geissler type. Apparent glycerol content from sp. gr. was obtained by use of Bosart and Snoddy's table [I. and E. C. 19,506 (1927)]. For the sake of ready comparison specific gravities corrected to 25°/25° C. are tabulated.

Water: Eight laboratories determined moisture. Six employed vacuum desiccation methods and two the distillation method devised recently by Hoyt and Clark (*Oil and Fat Ind.*, Feb. 1931, pp. 59-61).

Laboratory No. 1 dried 1.5-2.0 gms. in a crystallizing dish over conc. H_2SO_4 under 1-2 mm. of Hg. pressure. The loss after three days was considered moisture, though further losses occurred on drying for six, nine and twelve days which must have represented volatilization of glycerol itself.

Laboratories 3, 4, 6, 10, and 11 dried on glass wool over P_2O_5 (Dupont's Modification of Rojahn's Method[1]). The loss after twenty-four hours under 12-18 mm. Hg. pressure was generally reported as moisture. Laboratory No. 4 found twenty-four hours drying insufficient but four days gave close to con-

*Presented at Annual Meeting American Oil Chemists' Society, New Orleans, May 13-14.

[1]Lawrie—"Glycerol and the Glycols," P. 298.

stant weight. Laboratory No. 6 reported loss after twenty-four hours but noted additional losses on further exposure. Laboratory No. 10 dried under 20-23 inches vacuum to constant weight (time not stated). Laboratory No. 11 dried for forty-eight hours under 35 mm. pressure.

Laboratories 5 and 9 employed the distillation method of Hoyt and Clark. Laboratory No. 9 modified this method to the extent of using the bichromate method for estimation of glycerol in the aqueous distillate after previous dilution and boiling to expel toluene.

Apparent Glycerol by Acetin Method: The International Standard Method was employed by all laboratories, the figure reported being gross acetin uncorrected for acetylizable impurities in the residue. The precautions concerning carbonate-free NaOH, care in neutralizing prior to saponification and accurate standardization of acid seem to have been observed punctiliously. The following slight deviations from the standard method were reported: No. 5—(a) Sample not over 1.25 gms. (b) Acetylization time ninety minutes. (c) Saponification time twenty minutes. No. 10—Acetylization time two hours.

Apparent Glycerol by Bichromate Method: As was anticipated, the bichromate method was most productive of variation in the details of its application. Each chemist was requested to follow the procedure regularly used by his laboratory, or that modification of the standard method which seemed to him most suitable and accurate. The matter of purification with silver or lead was left open and only No. 7 carried it out using 0.2 the regular amount of silver carbonate and a reduced amount of basic lead acetate.

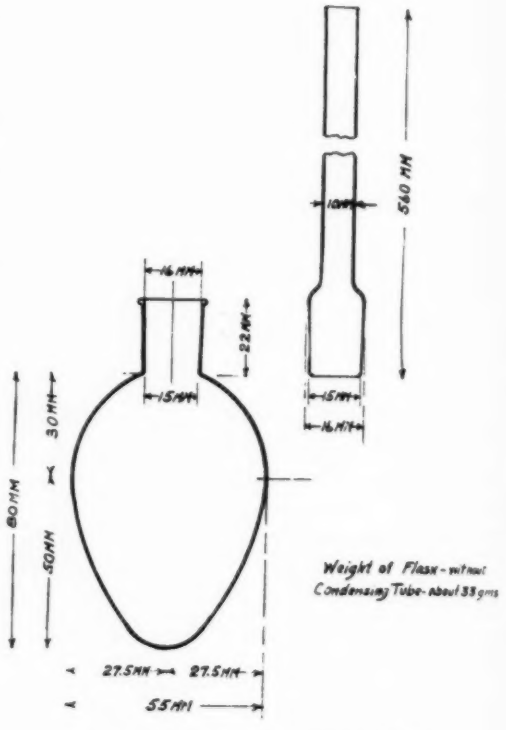
Ten laboratories reported results by the bichromate method. Several ingenious modifications are described:

Laboratory No. 1: 0.35-0.45 gm. in a 250 ml. beaker + 50 ml. $K_2Cr_2O_7$ sol'n (1 ml. = 0.01 gm. glycerol) + 25 ml. conc. H_2SO_4. Refluxed under stemless 3" funnel and watch glass on steam bath for thirty minutes. Cooled and diluted to exactly 300 ml. This sol'n was used to titrate a standardized ferrous ammonium sulphate sol'n equivalent to 0.01 gm. glycerol (approx. 20 cc.) using diphenylamine indicator.

$$\% \text{ Glycerol} = \frac{50\ (T\text{-}6)}{T \times S}$$

Laboratory No. 2: Excess $K_2Cr_2O_7$ = 35-40%. H_2SO_4- 25cc. of 1:1 by volume in a total of 90 cc.; oxidation time three hours in a boiling water bath; $K_2Cr_2O_7$ standardized vs. Fe wire of known purity.

Laboratory No. 4: Standard method followed. $K_2Cr_2O_7$ added from weighing bottle. Ferrous salt used in sol'n as described under "Reagents." 1-2 cc. of this sol'n was added in excess and titrated back with dilute $K_2Cr_2O_7$ sol'n. Herner's old method yielded results 0.1-0.3% lower than the Standard Method which is the one reported.



Preferred Type of Acetylization Flask

Laboratory No. 5: $K_2Cr_2O_7$ sol'n = 74,552 gms./liter. Sample = 1.2-1.5 gms./500 cc. 50 cc. of this dilution + 25 cc. std. $K_2Cr_2O_7$ sol'n + 25 cc. conc. H_2SO_4 in 400 cc. beaker were covered with watch glass and immersed in steam bath for two hours. Cooled, diluted to 500 cc. exactly and a 50 cc. aliquot taken. Added 75 cc. water + 10 cc. 1:4 H_2SO_4 + 20 cc. 10% KI sol'n. Liberated iodine was titrated with 0.1 N thiosulfate.

Laboratory No. 6: Followed Bichromate International Method (Scott's "Standard Methods," 4th Ed. Vol. 2, p. 1755). Approx. 5 gms. was diluted to def. vol. and an aliquot of this sol'n containing 0.45-0.47 gm. glycerin was used for oxidation.

Laboratory No. 7: Used International Standard Bichromate Method published in J. I. E. C. 3, 682 (1911). Purification was effected as noted above.

Laboratory No. 8: Presumably the Standard Method was used. No details given.

Laboratory No. 9: From a stoppered weighing bottle weighed 7-8 gms./2000 cc. 50 cc. aliquot = 0.175-0.200 gms. + 25 cc. standard bichromate sol'n (74.56 gms. C.P. $K_2Cr_2O_7$ + 150 cc. conc. H_2SO_4 per liter) + 15 cc. conc. H_2SO_4. This mixture, volume approx. 90 cc. and containing 18.75 cc. conc. H_2SO_4, was digested for two hours in a boiling water bath in a 250 cc. wide mouth Erlenmeyer covered with a watch glass. Cooled and titrated electrometrically with approx. 0.75 N. ferrous ammonium sulphate sol'n.

Laboratory No. 10: An aliquot corresponding to 0.1-0.15 gm. of glycerin, was added to 25 cc. of standard $K_2Cr_2O_7$ sol'n. (1 cc. = 0.01 gm. glycerol) + 15 cc. conc. H_2SO_4. Immersed in a boiling water bath for two hours, cooled and titrated with a standardized ferrous ammonium sulphate sol'n, using potassium ferricyanide indicator.

Laboratory No. 11: About 5 gms./1000 cc. 25 cc. aliquot + 25 cc. standard bichromate solution (74.56 gms. per liter) + 15 cc. conc. T_2SO_4. Heated on steam bath two hours and titrated with ferrous ammonium sulphate sol'n (240 gms./liter) using potassium ferricyanide indicator.

IT WILL be noted that a rigid uniformity of procedure prevailed only in the application of the International Acetin Method. Four distinct schemes for titrating the excess $K_2Cr_2O_7$ are represented in the bichromate methods; two general methods for water determination were employed with enough modifications of minor detail to increase this number to at least five or six. It is very doubtful if any two laboratories employed exactly the same technique in applying the specific gravity test. Keeping these facts in mind, the results, which at first glance appear very disappointing, are not at all bad and enable clearcut conclusions to be drawn.

1. Apparent glycerol content calculated from specific gravity using the Bosart and Snoddy table in excellent agreement with the water found.
2. Apparent glycerol content by bichromate oxidation is about 0.3% lower than apparent glycerol from specific gravity.
3. Apparent glycerol content by acetin method is about 0.8% lower than that by bichromate method and 1.1% lower than apparent glycerol from specific gravity.

These conclusions are the same whether drawn from averages of all four samples or from sample "B" which was purified by fractional vacuum distillation in a manner similar to that employed by Bosart and Snoddy. The probable errors attached to these accepted values are sufficient to account for most if not all of the discrepancy between bichromate and specific gravity but the errors attached to these analyses are not an adequate explanation for the wide disagreement between specific gravity and bichromate on the one hand and acetin on the other. This discrepancy, which was noted in the report of the Soap Section last year, is now considered proved. Its cause now becomes our active problem.

No claim is made for the absolute purity of sample "B" other than that it duplicates fairly closely the glycerol which Bosart and Snoddy regarded as pure. The impurities, other than water, which are most likely to be present are trimethylene glycol and polyglycerol ethers. Fractional vacuum distillation would eliminate the higher polymers so that the polyglycerol ethers in such a sample as "B" must be confined almost exclusively to diglycerol. The physical and chemical properties of trimethylen glycol and diglycerol are known and their apparent glycerol contents by bichromate and acetin methods are easily calculated. If a purified glycerine such as "B" is assumed to contain glycerol, trimethylene glycol, diglycerol ether, water and nothing else, its composition can be calculated from its specific gravity and apparent glycerol content by the bichromate and acetin methods if these methods really do yield the theoretical values and no change in volume takes place on mixing.

The following data on these substances are taken from Lawrie:

Substance	Specific Gravity 20°/20°C	% Apparent Glycerol Bich.	Acetin
Glycerol	1.26362	100.00	100.00
Trimethylene Glycol	1.0554	138.33	80.69
Diglycerol Ether	1.3215†	110.84	73.90
Water	1.00000	0.00	0.00

Let:
X=% glycerol
Y=% trimethylene glycol
Z=% diglycerol ether
W=% water

And:
S=% Specific Gravity 20°/20° C
A=% App. Glyc. (Acetin)
B=% App. Glyc. (Bich.)

Then:

$$\% \text{ Glycerol } (X) = 2.9229\ A - 1.6660\ B - 97.48\ (S - 1).$$

$$\% \text{ Trimethylene Glycol } (Y) = 0.9661\ B - 0.2234\ A - 281.72\ (S - 1).$$

$$\% \text{ Diglycerol Ether } (Z) = 1.995\ B - 2.3581\ A + 439.51\ (S - 1).$$

$$\% \text{ Water } (W) = 100.00 - 0.3414\ A - 0.4996\ B - 60.31\ (S - 1) \text{ or } 100.00 - (X + Y + Z).$$

† As there are three possible isomers of diglycerol, this figure is a bit uncertain.

Glycerin Analysis Results of Cooperating Laboratories

Number of Cooperating Laboratory	Sample "A" Sp. Gr. at 25°/25° C	Sample "A" % Glycerol From Sp.Gr.	Sample "A" % Glycerol Bich.	Sample "A" % Glycerol Acetin	Sample "A" % Water	Sample "B" Sp. Gr. at 25°/25° C	Sample "B" % Glycerol From Sp.Gr.	Sample "B" % Glycerol Bich.	Sample "B" % Glycerol Acetin	Sample "B" % Water	Sample "C" Sp. Gr. at 25°/25°C	Sample "C" % Glycerol From Sp.Gr.	Sample "C" % Glycerol Bich.	Sample "C" % Glycerol Acetin	Sample "C" % Water	Sample "D" Sp. Gr. at 25°/25°C	Sample "D" % Glycerol From Sp.Gr.	Sample "D" % Glycerol Bich.	Sample "D" % Glycerol Acetin	Sample "D" % Water
1	1.2497	95.24	92.68*	94.17	5.44*	1.2495	95.16	94.33	93.91	5.15	1.2491	95.00	93.34	93.78	5.24	1.2492	95.04	93.28*	93.56	5.24
2	1.24987	95.30	95.44	93.18*	----	1.24995	95.33	96.19	93.21	——	1.2496	95.20	96.16	93.15	——	1.2496	95.12	96.38*	92.92	——
3	1.25000	95.35	------	93.23*	4.59	1.25013	95.40	------	94.00	4.52	1.24948	95.15	------	93.67	4.70	1.24946	95.14	------	93.51	4.65
4	1.24945	95.13	95.01	94.47	4.67	1.24925	95.06	94.93	94.53	4.78	1.24885	94.91	94.79	94.43	4.95	1.24875	94.87	94.76	94.37	5.08
5	1.24835*	94.72*	94.29	93.96	4.68	1.24969	95.23	94.42	94.96	4.96	1.24905	94.98	94.19	94.51	4.60	1.24929	95.07	94.67	94.45	4.98
6	1.24975	95.26	95.58	94.35	4.40	1.24945	95.14	95.65	94.32	4.38	1.24955	95.18	95.56	94.19	4.35	1.24925	95.06	95.48	94.12	4.32
7	1.2497	95.24	94.24	93.91	——	1.2498	95.27	94.73	93.95	——	1.2494	95.12	94.15	93.82	——	1.2494	95.12	94.83	93.80	——
8	1.2502	95.43	95.27	94.31	——	1.2505	95.55	95.45	93.68	——	1.2494	95.12	95.16	93.98	——	1.2497	95.24	95.49	93.86	——
9	1.2497	95.24	94.82	94.56	4.63	1.2496	95.20	95.17	94.41	4.64	1.2492	95.04	94.67	94.59	4.80	1.2492	95.04	94.81	94.62	4.61
10	1.2500	95.35	94.42	94.67	4.51	1.2499	95.51	94.52	94.26	4.54	1.2492	95.04	93.78	94.28	4.62	1.2490	94.96	93.64*	94.32	4.65
11	1.2502	95.43	94.64	94.51	4.56	1.2496	95.20	94.64	94.29	4.71	1.2491	95.00	94.21	93.78	4.79	1.2492	95.04	94.50	93.25	4.78
Average (all included)	1.24972	95.24	94.64	94.14	4.71	1.24977	95.26	95.00	94.14	4.73	1.24935	95.10	94.62	94.01	4.75	1.24934	95.09	94.76	93.96	4.88
Average (accepted value)	1.24986	95.30	94.86	94.35	4.60	1.24977	95.26	95.00	94.14	4.73	1.24935	95.10	94.62	94.01	4.75	1.24934	95.09	94.94	93.96	4.88
Probable error of accepted value	0.00005	0.02	0.11	0.06	0.03	0.00007	0.03	0.15	0.09	0.06	0.00005	0.02	0.18	0.09	0.04	0.00005	0.02	0.10	0.12	0.04
Probable error of individual determination	0.00016	0.06	0.33	0.19	0.09	0.00023	0.09	0.40	0.31	0.17	0.00017	0.07	0.56	0.29	0.18	0.00017	0.07	0.26	0.39	0.18
Accepted Water + Accepted Glyc.		99.90 ± 0.05	99.46 ± 0.14	98.95 ± 0.09			99.99 ± 0.09	99.73 ± 0.19	98.87 ± 0.15			99.85 ± 0.08	99.37 ± 0.24	98.76 ± 0.15			99.92 ± 0.08	99.77 ± 0.16	98.79 ± 0.18	

* Values rejected by Farnsworth's method. See Farnsworth - "Quantitative Analysis", page 26 (1926)

Applying these formulæ to the accepted values of "B":

% Glycerol	= 92.38
% Trimethylene Glycol	=—0.09
% Diglycerol Ether	= 2.48
% Water	= 5.23

From theoretical considerations a mixture such as the above would have a specific gravity and would show bichromate and acetin analyses corresponding to those found. The water actually determined is, however, 0.50% lower than the theoretical. Furthermore a diglycerol content of 2.48% would surely yield a distinct organic residue at 160° C. Such was not the case, as the writer's laboratory found only 0.06% organic residue.

Reluctantly then, we are forced to the conclusion that one or more of these analyses is not yielding the theoretical value. The finger of suspicion points most directly at the acetin test and it is natural to investigate first that part of the International Acetin Method which is likely to be most productive of low results and in the performance of which the method itself urges particular care, viz: the saponification of the triacetin.

Lack of time prevented further cooperative work this year by the committee on such an investigation but a few experiments in the writer's laboratory point the way to interesting and necessary future cooperative work.

A sample of Eastman's Triacetin, No. 256, B.P. 152°-154°C./22 mm. was used for the purpose.

1. Two samples of about 2.25 gms. each were acetylized and analyzed for glycerol by the International Acetin Method.

(a) = 42.08%; (b) = 42.12%; Average = 42.10%.

2. Two samples of about the same size were dissolved in 400 cc. cold CO_2—free water, neutralized to phenolphthalein (1 drop of N/I NaOH sufficient), saponified and glycerol calculated as above.

(c) = 41.63%; (d) = 41.70%; Average = 41.67%.

3. Two similar samples were dissolved in about 300 cc. of cold CO_2—free water, 7.5 cc. glacial acetic acid and 3.0 gms. fused sodium acetate were added and the subsequent neutralization, saponification and titration made as in the I. A. M.

(e) = 41.28%; (f) = 41.20%; Average = 41.24%.

4. Another sample was acetylized and analyzed according to the I. A. M. except that the alkali used for neutralization was run in rapidly without any agitation whatever until within about 20 cc. of the neutral point. From then on the analysis was performed in the usual manner.

(g) = 40.85%.

Two blanks on reagents were carried out with each pair of samples. All of these analyses were performed by an experienced analyst and except where otherwise noted the neutralizations were made with unusual care to avoid local excess of alkali.

It is evident from the above analyses that this sample contained a small amount of free hydroxyl, probably present as di- or perhaps mono-acetin. The theoretical glycerol yield of triacetin is 42.21%; of diacetin is 52.28%, and of monoacetin is 68.66%. The loss of glycerol due to saponification during a careful neutralization amounts to 0.43% based on the eight of triacetin taken, but based on a 1.0 gm. sample of 95% glycerin yielding the same weight of pure glycerol, this loss figures 0.97% which is in close agreement with the observed discrepancy.

Conclusions: From its work on distilled glycerins your committee concludes that the discrepancy noted last year is a real one and that the acetin method itself is the primary cause. It is suggested that further cooperative work be done with the object of determining more accurately the factors causing this error with a view to its elimination if possible. It is suggested that any further work include, if possible, a distilled glycerin from a saponification crude.

Your committee further recommends that whenever the International Acetin Method is employed, the acetylization flask used be similar in size and shape to that shown in the drawing. The condenser tube should be water-jacketed as described in the I. A. M. This flask can be purchased with new interchangeable ground glass joints at separate prices on flask, condensing tube and a stopper for use while weighing.

In conclusion your chairman wishes to thank each member of the committee for his loyal support and fine spirit of cooperation during the performance of our task.

The roster of your committee is as follows:

W. H. Burkhardt, Gold Dust Corp., Holabird and Vail Sts., Baltimore, Md.; Chas. G. Gundel, Fels & Company, Philadelphia, Pa.; C. A. Woodbury, E. I. duPont de Nemours Co, Explosives Dept., Wilmington, Del.; Ralph W. Bailey, Stillwell & Gladding, Inc., New York, N. Y.; L. F. Hoyt, Larkin Co., Inc., Buffalo, N. Y.; A. K. Church, Lever Bros. Co., Cambridge, Mass.; James W. Lawrie, A. O. Smith Corp., Milwaukee, Wis.; V. K. Cassady, The Palmolive Co., Milwaukee, Wis.; W. J. Reese, Colgate-Palmolive-Peet Co., Kansas City, Kansas; Wm. A. Peterson, Kirkman & Son, Brooklyn, N. Y.; M. L. Sheely, Armour Soap Works, Chicago, Ill.; John Ornfelt, La France Mfg. Co., Philadelphia, Pa.; H. C. Bennett, Los Angeles Soap Co., Los Angeles, Calif.; J. T. R. Andrews, *Chairman*, Procter & Gamble Co., Ivorydale, Ohio.

Cottonseed and Oil Stocks Sharply Down June 30th

The Preliminary Report of the Bureau of the Census, Department of Commerce, issued July 13th, giving figures of cottonseed received, crushed and on hand, and cottonseed products manufactured, shipped, exported and on hand for the eleven months ending June 30, 1931, with comparative figures for the same period ending June 30th, 1930, showed a reduction of crude oil stocks of 38 percent, from 22.3 million to 13.9 million pounds, and a reduction in cottonseed on hand at the mills of 57 percent, from 77.1 thousand to 33.2 thousand tons, comparing figures for June 30th, 1931 and 1930. The complete report follows:

COTTONSEED RECEIVED, CRUSHED, AND ON HAND (TONS)

States	Received at mills* Aug. 1 to June 30		Crushed Aug. 1 to June 30		On hand at mills June 30	
	1931	1930	1931	1930	1931	1930
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
United States	4,681,858	4,991,627	4,694,037	4,953,954	33,237	77,164
Alabama	399,714	346,860	399,405	345,241	575	2,810
Arizona	63,906	62,387	64,103	62,453	49	97
Arkansas	251,094	430,715	253,335	423,981	809	7,816
California	127,862	120,341	130,503	106,407	5,499	14,047
Georgia	668,004	484,719	667,319	483,693	1,414	1,623
Louisiana	202,825	228,648	202,910	232,682	585	392
Mississippi	572,205	809,215	578,191	785,930	3,989	29,157
North Carolina	290,967	266,530	290,406	265,978	925	1,003
Oklahoma	248,995	354,230	249,077	356,552	2,200	1,533
South Carolina	280,457	218,320	280,172	218,305	679	608
Tennessee	261,617	338,277	264,025	331,442	187	7,911
Texas	1,250,644	1,261,210	1,251,198	1,270,987	16,149	10,165
All other States	63,568	70,175	63,393	70,303	177	2

* Includes seed destroyed at mills, but not 45,434 tons and 41,606 tons on hand August 1, nor 71,755 tons and 99,201 tons reshipped for 1931 and 1930, respectively.

COTTONSEED PRODUCTS MANUFACTURED, SHIPPED OUT, AND ON HAND

Item	Season	On hand Aug. 1	Produced Aug. 1 to June 30	Shipped out Aug. 1 to June 30	On hand June 30
Crude oil ..... pounds	1930-31	[1]7,893,957	1,434,863,644	1,431,453,605	[1]13,918,562
	1929-30	19,181,886	1,552,896,323	1,554,494,135	22,327,878
Refined oil ..... pounds	1930-31	[2]301,609,092	[3]1,306,967,107	.....	[2]348,438,087
	1929-30	338,619,933	1,382,981,615	.....	393,572,899
Cake and meal ..... tons	1930-31	55,352	2,153,651	2,016,867	192,136
	1929-30	76,667	2,203,465	2,194,855	85,277
Hulls ..... tons	1930-31	28,495	1,297,460	1,256,885	69,070
	1929-30	63,917	1,366,054	1,387,207	42,764
Linters ..... running bales	1930-31	135,220	820,566	747,168	208,618
	1929-30	70,854	1,024,260	934,992	160,122
Hull fiber ..... 500-lb. bales	1930-31	2,659	49,727	48,843	3,543
	1929-30	1,848	75,784	74,730	2,902
Grabbots, motes, etc. ..... 500-lb. bales	1930-31	12,776	35,882	33,894	14,704
	1929-30	8,453	46,870	39,267	16,056

[1] Includes 1,932,090 and 2,451,056 pounds held by refining and manufacturing establishments and 3,558,420 and 5,664,020 pounds in transit to refiners and consumers August 1, 1930 and June 30, 1931, respectively.
[2] Includes 6,038,528 and 5,881,215 pounds held by refiners, brokers, agents, and warehousemen at places other than refineries and manufacturing establishments, and 5,919,817 and 2,716,555 pounds in transit to manufacturers of lard substitute, oleomargarine, soap, etc., August 1, 1930 and June 30, 1931, respectively.
[3] Produced from 1,431,463,723 pounds of crude oil.

EXPORTS OF COTTONSEED PRODUCTS FOR TEN MONTHS ENDING May 31

Item	1931	1930
Oil—Crude ..... pounds	9,450,763	24,741,772
Refined ..... pounds	14,921,521	4,992,673
Cake and meal ..... tons of 2,000 pounds	43,099	157,870
Linters ..... running bales	96,618	104,223

Report on Tintometer Standardization

Color Committee of American Oil Chemists' Society Recommends Adoption of Standard Instruments, Glasses and Tubes

By W. D. HUTCHINS, *Chairman*

YOUR Committee has considered the standardization of a tintometer including source of illumination, magnesia block, and color tubes. We had hoped to be able to recommend to you an instrument for adoption as a Standard giving the detailed specifications and measurements, but our plans did not materialize, or rather were not completed. We were unable to get some of the important suggestions actually tested due to unavoidable delay in getting trial instruments made.

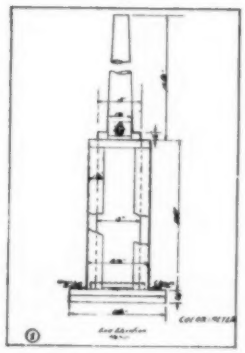
The type of eye-piece and the principle involved in it were considered thoroughly and the majority of the Committee felt that we should recommend the simple eye-piece in preference to the eye-piece making use of prisms. The position of the Committee might be best expressed by the following paragraph from one of Priest's communications:

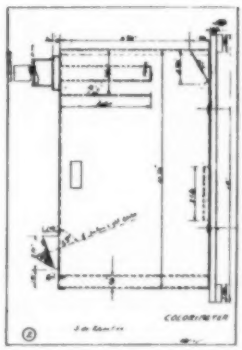
"I believe there is but little advantage and considerable disadvantage in bringing the color of the oil and the color of the glasses into close juxtaposition in the field of view *unless due care is also taken to make measurements of relative brightness.* Since such measurements are never made and, so far as I know are not contemplated, the conclusion is that the simpler instrument is to be preferred. If brightness measurements were to be made, a more perfect condition of immediate juxtaposition would be requisite than is obtained in any 'tintometer' I have ever seen."

Recommendations

FEELING the urgent need of a standard tintometer and considering the many requests for such, the committee recommends that the Society adopt as a tentative standard the Enclosed Wesson Type Instrument illustrated by the attached drawings.

2. That the Standard Set of Lovibond Color Glasses be changed so as to include 50 yellow glass and 70 red glass for laboratories making analyses of corn and soya bean oils, and that the clause "Red Glasses to be standardized by the U. S. Bureau of Standards" be changed so as to read: "The Red Glasses to be standardized by the U. S. Bureau of Standards, but the actual color value does not have to be the exact numerical number shown on the glasses."





Drawings 1 & 2

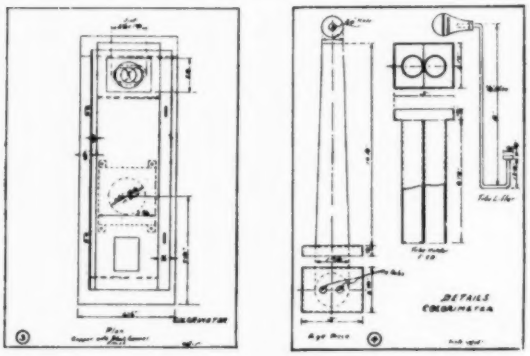
3. We recommend that the Society have a supply of the Standard Color tubes manufactured and furnish them to the members at cost.

Recommendation No. 1, referring to the tentative tintometer, does not meet with the unanimous approval of the Committee. The Rule covering determination of color has been rewritten so as to embody the recommendations made, and copy of the revised rule is attached to this report. We suggest that the incoming Committee continue the investigational work already begun on the illumination of the tintometer, and especially the question of whether a blue daylight filter in the eye-piece gives more constant and uniform light than the Mazda Daylight Lamp which is now official. We wish to thank Irwin G. Priest for his very kind assistance and advice.

Color

(a) *Apparatus*:

THE tintometer shall be a light-proof metal box with dull black interior, corresponding in detail to the measurements and specifications shown on Drawings, Nos. 1, 2, 3, 4, and 5.



Drawings 3 & 4

Light Bulb—The illumination of the tintometer shall be furnished by a 100-watt frosted Mazda Daylight Lamp located in the tintometer in accordance with angle shown in Drawing No. 2.

Magnesia Block—To be used as light reflector in the tintometer, shall be 1" x 2¾" x 3¾" in size.

Lovibond Standard Color Glasses—Red and yellow, of suitable numbers to match the color of the oils to be examined. The minimum standard set shall consist of the following numbers of red and yellow glasses:

Red:	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	1.0	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0
	7.6	8.0	9.0	10.0	11.0	12.0	16.0	and	20.0
Yellow:	1.0	2.0	3.0	5.0	10.0	15.0	20.0	and	35.0

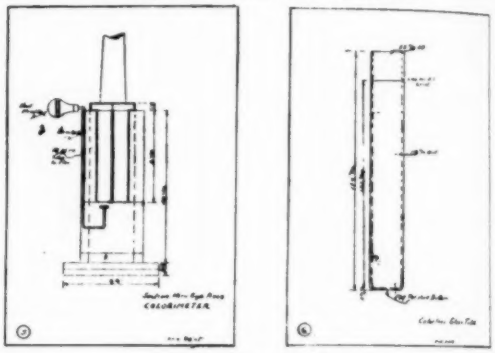
Laboratories analyzing corn and soya bean oils shall have the additional glasses, 30 yellow and 70 red.

Red Glasses to be standardized by the U. S. Bureau of Standards, but the actual color value does not have to be the exact numerical number shown on the Glasses.

Color Tubes—Shall have a flat, smooth, polished bottom of clear colorless glass and of the following dimensions: length 154 mm over all, 19 mm inside diameter, and provided with a mark to indicate oil column of 133 mm (Drawing No. 6).

(b) *Determination*:

FILL a tube with the oil to be examined to a depth of 133 mm. Oil must be at a temperature of 20° to 24° C., and must be clear and transparent. Filter through good heavy grade, close texture, white filter paper at 20° C. to 24° C. if necessary to remove turbidity to permit matching the color, and in such cases note on your report that filtering was necessary. If, however, the oil or fat under examination is not completely liquid at 20° C., heat until completely liquefied, and read the color at a temperature not more than 10° C. above that at which it becomes completely liquefied. Place the tube containing the oil in the tintometer and place alongside of it such yellow and red glasses as are necessary for making the comparison desired, observing the colors of the oil and the glasses through the eye-piece. When only two color glasses are used a colorless glass must also be used so that three glasses will be used in all cases. In matching the color, use only one yellow glass, not more that two red glasses up to and including 13.0 red, and not more than three red glasses above 13.0. red. Report the numbers of the yellow and red glasses which match the color of the oil; or if a standard combination is specified (as prime for example) report whether the oil is prime or off as compared with the standard.



Drawings 5 & 6

Sumatran Palm Oil—1930

The total area planted to palm oil trees in the Dutch East Indies during 1930 was 144,224 acres. Out of this total 63,650 acres were producing. The total production of palm oil for 1930 was 120,822,574 pounds, or approximately 1,900 pounds per acre. During 1930 the Dutch areas planted in palm oil more than doubled, Dutch areas in production increased by 135 per cent, and Dutch palm oil production increased from 19,107,191 pounds in 1929 to 65,473,833 pounds in 1930. This enormous expansion in new areas was caused to a large extent by the difficulties into which the rubber industry has come, and by the faith of the planters that palm oil is destined to vie with rubber for the leading place in Sumatra's industries. The above figures do not take into consideration the largest producer of all, which refuses to divulge statistical information regarding its palm oil activities.

The Franco Belgian organizations showed increases in 1930 over 1929 of 6,051 acres in planting, 1,910 acres in production, and of 14,738,754 kilograms in yield. Small gains were also made by the German and Japanese producers, while the British palm oil industry in North Sumatra declined in number of acres planted while increasing in areas in production.

Kapok Oil and the Halphen Test*

Notes Describing the Extreme Activity of this Oriental Oil Toward the Sulfur-Bisulfide Reagent

By H. P. TREVITHICK *and* W. H. DICKHART

KAPOK OIL is the oil pressed from the seed of the kapok plant, a plant very similar to the cottonseed in general characteristics, common in the Orient, particularly in China. The seeds are round, about the size of a pea, with black hull, and white kernel. They are free from lint, being similar to "bald" cottonseed in that respect, and easy to crush.

A sample of such oil from imported seeds, crushed in an American crude oil mill, gave the following results on analysis:

Moisture & Volatile Matter	0.45%
Insoluble Impurities (meal)	0.36%
Specific Gravity (@ 15.5° C.)	0.9221
Iodine Value (Wijs)	94.9
Saponification Value	194.5
Index of Refraction	1.4710
Unsaponifiable Matter	0.66%
Free Fatty Acids (Oleic)	12.13%
Refining Loss	35. %
Color (Refined Oil)	35 Yellow 7.0 Red
Titre (Refined Oil)	28.1° C.
Titre (Soapstock Acids)	30.2° C.
Halphen Test	Strong—Immediate

Due to the fact that this oil and cottonseed oil are very similar, we made some comparative tests on the sensitivities of the two oils to the Halphen reaction. In these experiments, sesame oil, olive oil, palm kernel oil and coconut oil were used. After some preliminary experiments, a series of mixtures was prepared of each of these oils containing 0.05%, 0.1%, 0.5% and of 1% of kapok oils, and another series containing 0.5% and 1% of cottonseed oil in each of the above-mentioned oils. Each mixture was subjected to the Halphen reaction. In this test, 5 cc. of the oil mixture in a test tube is shaken with 5 cc. amyl alcohol, 5 cc. of a 1% solution of sulfur in carbon bisulfide is added, the whole heated cautiously in the steam bath until the bisulfide has evaporated; and the tube then heated in the boiling water bath for 5 hours, counting the time from the point at which the bulk of the carbon bisulfide is removed. The results were as follows:

COMPARATIVE HALPHEN TESTS

Oil Samples	Result of Test	Length of time to show color	Depth of red color in 5 hours
Sesame	Negative	5 hours	None
Olive	"	"	"
Coconut	"	"	"
Palm Kernel	"	"	"
Cottonseed	Positive	5 minutes	Very deep red
Kapok	"	2 minutes	" " "
Sesame plus 0.05% Kapok	Positive	20 minutes	Light pink
Olive " " "	"	30 "	" "
Coconut " " "	"	30 "	" "
Palm Kernel " " "	"	30 "	" "
Sesame plus 0.1% Kapok	Positive	20 minutes	Definite red
Olive " " "	"	" "	" "
Coconut " " "	"	" "	" "
Palm Kernel " " "	"	" "	" "
Sesame plus 0.5% Kapok	Positive	10 minutes	Deep Red
Olive " " "	"	" "	" "
Coconut " " "	"	" "	" "
Palm Kernel " " "	"	" "	" "
Sesame plus 0.5% C/S Oil	Positive	45 minutes	Light Red
Olive " " "	"	" "	" "
Coconut " " "	"	" "	" "
Palm Kernel " " "	"	" "	" "
Sesame plus 1% C/S Oil	Positive	40 minutes	Definite Red
Olive " " "	"	" "	" "
Coconut " " "	"	" "	" "
Palm Kernel " " "	"	" "	" "

(*Turn to page* 317)

*Presented at the Twenty-second Annual Meeting, American Oil Chemists' Society, New Orleans, May 13-14.

Census Summary of Fats and Oils, 1930

Year Marked by Lessened Production and Imports, Heavier Stocks, and Consumption at Practical Standstill

THE Bureau of the Census, U. S. Department of Commerce, has issued its annual summary of the production, consumption, imports, exports and stocks of animal and vegetable fats and oils, including fish oils and marine animal oils. The report is embodied in a bulletin of the Bureau, on sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at five cents per copy. The entire summarized report, excluding the detailed tables, is as follows:

THE statistics in this report relate to factory production, factory consumption, and factory and warehouse stocks. Three general classes of factories are canvassed for the data: (1) The producers of animal and vegetable fats and oils, including expressers, extractors, renderers, and reclaimers; (2) the consumers of fats and oils in the production of other fat and oil products, or products of which fats or oils form a constituent part, embracing primarily refiners, mixers, compounders, and the like, and secondarily manufacturers of varnish, soap, oilcloth, linoleum, etc.; and (3) manufacturers of tin plate, textiles, and leather, which products do not themselves contain or retain any considerable portion of the fats and oils used as agents in their manufacture.

The scope of these statistics might be further defined by describing it in a negative way. The figures of production do not include those considerable quantities of lard, tallow, and grease produced in the households, on the farms, and by the smaller local butcheries and meat markets. The figures of consumption do not include the quantities used either for culinary purposes by households, hotels, and bakeries, or by local painters, contractors, etc., or for lubrication purposes of any kind. The figures of stocks do not include any in the hands of householders, local tradesmen, retailers, wholesalers, or jobbers, except such as may be held in public warehouses. However, because importers and exporters sometimes hold considerable quantities of these commodities, data as to stocks are collected from that class of dealers.

The limitations of the statistics as indicated above must be borne in mind in any analysis of them. In addition, consideration should be given to the fact that the schedule used in collecting the data carries more than 60 items, some of which are so closely related in nature and use as to lead to some confusion of terms by those furnishing the data. A striking illustration of this condition is found in "Tankage grease." It seems to be the practice of most producers of grease to report under this heading all the production from certain classes of materials by whatever process obtained, and it is evident from the small amount of this grease reported as consumed that those who purchase it for consumption classify it specially as inedible tallow, yellow grease, brown grease, or merely grease. The production of bone grease also is much larger than the consumption reported, indicating that it is probably classified as tallow or yellow grease by consumers. There is doubtless some confusion also between hydrogenated oils and vegetable stearin; between the crude and the refined of any of the oils for which data for both kinds are asked; and between neutral and other edible lard.

Another factor operating to affect the statistics is the practice of some establishments of furnishing data for only the final products of rapidly successive processes of manufacture. This is due probably to the difficulty of determining accurately the quantities of the intermediate products made and consumed in a practically continuous process. Consequently, the figures for production and consumption of such commodities as vegetable oil foots, fatty acids, acidulated soap stocks, and, to some extent, other intermediate products fall short of the facts. But as they do represent in a qualified sense a net production and consumption during the periods covered they carry a certain statistical value. In this connection it should be stated that the figures for production

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of crude glycerin presumably represent the entire primary production of glycerin in this country. Those producers of crude glycerin who also do refining furnish sufficient data to make this possible. It is probable, therefore, that the production figures of chemically pure glycerin are also complete, but it is possible that the figures for the production and consumption of dynamite glycerin are somewhat below the facts for the reason stated at the beginning of this paragraph.

Table 1 is an index of the supply and distribution of three general classes of fats and oils as a whole. The quantities are shown in millions of pounds and the balancing item under the caption "Other consumption" represents the quantities used in homes, hotels, etc., and that consumed by the trades and those classes of factories not included in the scope of this inqiury as set forth in paragraphs one and two of the introduction.

TABLE 1.—SUPPLY AND DISTRIBUTION OF ANIMAL AND VEGETABLE FATS AND OILS FOR THE CALENDAR YEARS 1928 TO 1930

	Vegetable Oils			Edible Animal Fats[1]			Fish Oils		
	1930	1929	1928	1930	1929	1928	1930	1929	1928
	Millions of pounds								
Supply									
Total	4,810	5,077	4,660	1,721	1,985	1,965	396	342	316
Stocks at beginning of year	1,074	969	1,105	77	82	57	118	91	96
Primary factory production	2,719	2,951	2,736	1,643	1,901	1,894	111	116	86
Imports	1,017	1,157	819	1	2	14	167	135	134
Distribution									
Total	4,810	5,077	4,660	1,721	1,985	1,965	396	342	316
Stocks at end of year	1,105	1,074	969	50	77	82	198	118	91
Exports	76	90	115	662	852	787	2	1	2
Potential consumption[2]	3,629	3,913	3,576	1,009	1,056	1,096	196	223	223
Factory consumption[3]	2,960	3,077	2,864	68	74	74	165	188	206
Other consumption[4]	669	836	712	941	982	1,022	31	35	17

[1] Does not include oleo stock, for which no data were collected.
[2] Total supply minus exports during year and stocks at end of year.
[3] Amount of refined vegetable oils produced was deducted from total factory consumption of all kinds.
[4] Potential consumption minus factory consumption.

Vegetable Oils

SUPPLY.—The total supply of vegetable oils in 1930 was 4,810 million pounds as compared with 5,077 million pounds in 1929 and 4,660 million in 1928. The year 1930 started with 105 million pounds more stocks than 1929 and 31 million less than 1928. The production in 1930, however, was 232 million less than in 1929 and 17 million less than in 1928, while the imports during 1930 were 140 million less than during 1929 but 198 million more than during 1928.

Although the total primary factory production of vegetable oils in 1930 shows a loss of 232 million pounds as compared with the production in 1929 only three of the individual oils contributed to the decrease. Linseed oil shows a loss of 247 million; castor oil, 29 million; and corn oil, 13 million, a total of 289 million. Against these losses cottonseed oil showed a gain of 32 million; peanut oil, 9 million; soybean oil, 3 million; olive and palm-kernel oils, 1 million each, and "Other vegetable oils" 11 million, a total of 57 million. To the total production. "Other vegetable oils," 23,716,896 pounds, sesame oil contributed 21,993,134 pounds. So striking has been the increased activity in the production of this oil that, in the future, separate statistics will be shown for it in the regular quarterly reports.

Of the 140 million decrease in total imports of vegetable oils in 1930, as compared with 1929, sesame oils shows a loss of 11 million, which equals practically its increase in production. Four oils show a gross increase of 61 million pounds, viz, palm oil, 26 million; sulphur olive oil, 17 million; peanut oil, 12 million; and China wood oil, 6 million. The greater part of the peanut oil imported was either exported to Canada or held for export at the end of the year. The gross decrease in imports was 201 million pounds which, in addition to the 11 million shown by sesame oil, was distributed as follows: Coconut oil, 94 million; palm kernel, 31 million; soybean, 11 million; linseed oil, 8 million; edible olive oil and vegetable tallow, 4 million each; rapeseed oil and inedible olive oil, 3 million each; vegetable wax, 2 million; and miscellaneous vegetable oils not specified, 30 million.

Distribution.—By the end of 1930 total stocks of vegetable oils as a whole showed an increase of 31 million pounds over the beginning of the year, exports a decrease of 14 million pounds as compared with 1929, and potential consumption, arrived at by deduction, a decrease of 284 million. The factory consumption for the year as reported by those establishments within the scope of this inquiry was 2,960 million pounds, compared with 3,077 million in 1929 and 2,864 million in 1928. The balancing item under the caption "Other consumption" really represents the trade move-

ment toward those consumers not canvassed as stated in the introduction. This figure was 669 million for 1930, 836 million for 1929, and 712 million for 1928.

Edible Animal Fats

THE total supply of edible animal fats exclusive of oleo stock and the production and stocks of householders, bakers, meat markets, and wholesale and retail dealers, for which no data were collected, was 1,721 million pounds in 1930, 1,985 million in 1929, and 1,965 in 1928. Deducting from these amounts the sum of the stocks held over and the exports for each year, the potential consumption for 1930, 1929, and 1928 is respectively 1,009 million, 1,056 million, and 1,096 million. The reported factory consumption, used principally in the manufacture of lard and butter substitutes, was 68 million pounds in 1930 and 74 million in both 1929 and 1928, indicating a domestic trade absorption of 941 millions in 1930, 982 millions in 1929, and 1,022 millions in 1928. To arrive at a conception of the enormous quantities of factory produced animal and vegetable fats and oils consumed yearly by the American people for culinary purposes, the domestic consumption of lard substitutes should also be considered. An analysis of the supply and distribution of the commodities falling under this designation indicates that the consumption in 1930 was 1,206 million pounds as compared with 1,208 million in 1929 and 1,134 million in 1928.

Fish Oils

THE total supply of fish and marine animal oils in 1930 was 396 million pounds, a gain of 54 million over 1929 and 80 million over 1928. All items of supply were much heavier in 1930 than in either of the other two years shown in the table with the exception of production in 1929 which was 5 million pounds more than in 1930.

Of the 167 million pounds of these oils imported in 1930 whale oil, cod oil, and cod-liver oil represented almost 112 million. The remaining 55 million designated merely as "Other fish oils" includes almost 29 million "Herring, menhaden, sod oils" leaving over 26 million unclassified. This condition makes it impossible to determine the actual supply of the individual oils listed in Tables 2 and 3.

The total stock of fish oils at the end of 1930 was 198 million pounds, which is larger than the carry over from 1929 by 80 million, and from 1928 by 107 million. The indicated domestic consumption during 1930 was 196 million pounds as compared with 223 million for both 1929 and 1928.

■

Form Whale Oil Sales Combine

Surplus whale oil production for the 1930-31 season which estimates at Oslo place at 770,000 barrels according to Commercial Attache Lund at that city, will be sold through a newly formed syndicate so that this large quantity of oil will not be thrown on the market with depressing effect. The oil is in storage in Norway, England, Holland, and some in Hamburg. The large whaling companies who own the oil have formed the sales combine which will have offices located at Tonsberg, Norway, in charge of a Mr. Krogh-Hansen. It is hoped in this way to market the oil gradually at a reasonable price.

■

Ceylon Coconut Industry

Coconut products in Ceylon are going through the same depression that all other industries are experiencing. Shipment figures on copra, coconut oil, and coconuts are on an average about 5 per cent higher than for the first three months of last year, but prices all around hardly cover the cost of production and the strictest economy is being carried on on all estates. No new land is being opened up for coconuts at the present, and the estates have either considerably curtailed or stopped entirely their manuring programs.

Shipments of copra to the North Continental ports have not been great, the chief buyers appearing to be Trieste and Scandinavia.

■

The Vegetable Oil Products Company, Los Angeles, Calif., has appointed the Murray Oil Products Company, 17 Battery Place, New York, as its exclusive representative in the metropolitan district of this city and the city of Philadelphia. The company produces a complete line of waterwhite and yellow sesame oils.

■

A report from the Suva Consulate, Fiji, gives exports of copra for the year 1930 as 23,882 tons valued at $1,998,288 as compared with 33,226 tons valued at $2,744,599 exported during 1929.

■

Burma has the largest acreage sown to sesame, 1,291,000 acres with an estimated production of 75,000 tons during the 1930-31 season. United Provinces is next with an acreage of 1,103,000 acres and an estimated production of 112,000 tons. Madras third with acreage totaling 734,000 acres and production of 95,000 tons.

Solvents Committee Revises Specifications

Pentane Type Product Containing Minimum Amount of Hexane and Iso- Types Shown Most Desirable for Oil Extractions

By R. H. FASH, *Chairman*

THE present specifications of the American Oil Chemists' Society for petroleum ether are based upon a distillation test. Therefore, various mixtures of hydrocarbons can be made which would comply with the specifications, but, owing to the varying composition of these mixtures, there is a possibility of different amounts of extractive material being obtained on the same sample using different petroleum ethers. The investigation was first conducted to study the effect of varying the composition of the petroleum ether. The results obtained were such as to indicate that the temperature at which the extraction occurred influenced the amount of extracted material obtained. Therefore an investigation was made to determine the effect of varying the temperature at which extraction occurred.

Table I gives the results obtained upon extracting samples of cottonseed meal and cottonseed with various solvents. Table II gives the composition of some of the solvents.

Table I

				Av.
Cottonseed Meal				
Louisiana Gas	6.09%	6.06%	6.01%	6.05%
Skellysolve B	6.71 "	6.81 "	6.92 "	6.81 "
Skellysolve G	6.01 "	6.22 "	6.09 "	6.11 "
Skellysolve B 50% / Skellysolve G 50%	6.49 "	6.40 "	6.33 "	6.41 "
Cottonseed				
Louisiana Gas	18.00%*	18.77%	18.68%	18.72%
Skellysolve B	19.53 "	19.58 "	19.45 "	19.52 "
Skellysolve G	18.58 "	18.18 " *	18.60 "	18.59 "
Skellysolve B 50% / Skellysolve G 50%	18.91 "	18.70 "	18.69 "	18.77 "

Note: *—not considered in average.

Table II

	Skellysolve A	B	G	F	Louisiana Gas
Iso-pentane	0.71%		Trace	3.39%	36.09%
Normal pentane	97.73		28.04	70.36	25.75
Iso-hexane	1.56	0	5.06	5.05	5.02
Normal hexane		100	60.55	21.20	28.92
Heptane			5.81		4.22

Table III gives the results obtained upon extracting cottonseed meal with various mixtures of Skellysolve A and Skellysolve B compared with Louisiana Gas.

Table III

Skellysolve A	Skellysolve B	Oil %			Av.
100%	0%	5.25	5.22	5.18	5.18
80	20	5.24	5.25	5.24	5.24
60	40	5.25	5.29	5.20	5.25
40	60	5.41	5.20	5.30	5.30
20	80	5.44	5.45	5.33	5.41
0	100	5.50	5.47	5.42	5.46
	Louisiana Gas	5.03	5.05	5.04	5.04

Table IV gives the results obtained on extracting cottonseed with mixtures of Skellysolve A and Skellysolve B, the cottonseed being handled in different ways with regard to preheating the seed in order to determine the effect of preheating upon the amount of ex-

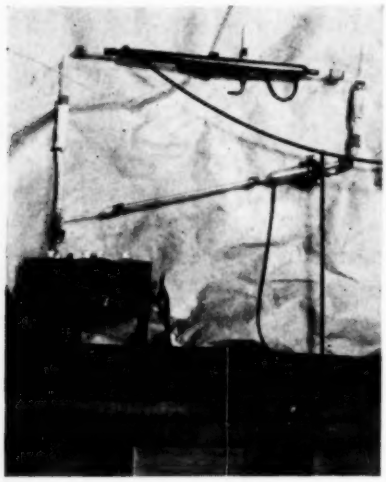

Figure I

tracted material obtained. The question had been raised as to whether in the preheating of the seed as carried out in practice, where the seed are in a mass, the desired polymerization of resinous materials was obtained. The preheating of the seed where the seed were spread out in a layer only one seed thick insured that the seed in this sample received the desired heating. The results indicate very little difference between the present procedure and heating in a thin layer.

In studying the results obtained using various solvents, A. K. Schwartz suggested that possibly the temperature at which extraction occurred and not the composition of the solvent was the deciding factor in determining the amount of extracted material obtained. If this were so, then, by extracting cottonseed with different solvents at the same temperature, the same amount of extracted material should be obtained, and the amount obtained should be greater the higher the temperature of extraction. In order to do this, the apparatus shown in figure I was arranged.

The temperature at which extraction occurs is regulated by the temperature of the water in the long condenser. The tube carrying the condensed solvent dips below the level of the liquid in the flask, while the small condenser prevents vapor from the flask entering the extraction tube. The tube carrying the vapor to the long condenser is fitted on the outside with nichrome wire through which an electric current is passed to heat the tube so that with the higher boiling point solvents sufficient solvent will be carried to the condenser to maintain the drops per minute required. The tube from the condenser to the extractor must be insulated to maintain the temperatures desired.

Table IV

Solvent Skellysolve A	B	Regular Official L	No Preheating M	1 Seed layer preheating P
100%	0%	16.67 16.58 16.31 Av. 16.52	16.33 16.81 Av. 16.57	16.62 16.44 16.60 Av. 16.55
80	20	16.14 16.16 16.22 Av. 16.17	16.81 16.66 16.67 Av. 16.71	16.73 16.43 16.70 Av. 16.62
60	40	15.97* 16.54 16.37 Av. 16.46	17.07 17.08 16.42* Av. 17.07	16.17 16.61 16.34 Av. 16.38
40	60	16.46 16.42 16.35 Av. 16.41	17.07 16.89 16.87 Av. 16.93	16.85* 16.34 16.47 Av. 16.40
20	80	—— 16.59 16.42 Av. 16.50	17.07 16.74 16.77 Av. 16.86	15.86* 16.60 16.49 Av. 16.55
0	100	16.91 16.56 16.72 Av. 16.73	17.18 17.09 16.73* Av. 17.14	16.68 16.63 16.35 Av. 16.55
Louisiana Gas		16.21 16.37 16.58 Av. 16.39	16.83 16.33 16.54 Av. 16.34	16.96* 16.34 16.23 Av. 16.28
Moisture, Ground			2.72%	7.47% 1.76%
Original Moisture			10.18 "	10.00 " 9.93 "

All figures calculated to 10% moisture basis Note: * not considered in average

The results obtained using this equipment are given in Table V. These results confirm the theory that the amount of extracted material obtained is dependent upon the temperature of extraction and not the chemical composition of the paraffin hydrocarbons used as a solvent.

Table V

Temp. ° F.	Skellysolve A	Skellysolve B	Louisiana Gas
55	18.47%—18.53% av. 18.50%	18.55%—18.42% av. 18.49%	18.37%—18.32% av. 18.35%
80	18.85 " —18.77 " av. 18.81 "	18.60 " —18.70 " av. 18.65 "	18.92 " —18.75 " av. 18.83 "
105	Too warm	19.01 " —18.93 " av. 18.97 "	19.03 " —19.17 " av. 19.10 "
130	Too warm	19.26 " —19.21 " av. 19.24 "	Too warm

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Notes of the Industry

Brazilian Lard Exporting

It is reported that the Sociedade de Banha Sul Rio Grandense of Porto Alegre, Brazil, which is the commercial department of the Lard Syndicate of Rio Grande do Sul, intends to change the manner of packing refined lard which is exported to European markets. The present practice is to pack the product in tin containers of different sizes. The Society now intends to chill the lard in standard export blocks, each weighing 28 pounds, wrapped separately in wax paper.

It is also reported that the refined lard which is destined to the various European markets will be exported to Liverpool where a central distributing warehouse, under the direction of a British expert specially contracted by the Lard Society will dispatch the product for sale in England and on the Continent.

■

American Chemical Society

The eighty-second annual meeting of the American Chemical Society will be held at the Hotel Statler, Buffalo, New York, during the week of August 31. The opening event of the meeting will be a symposium on "New Research Tools," in which twelve important new adjuncts to research will be discussed.

■

The B. S. Pearsall Butter Company, manufacturers of butter, cheese and oleomargarine, have announced entry into the manufacture of tinned soups, tomato juice and tomato juice cocktail. The new products will be manufactured at Plainville, Indiana and also at the company's main plant at Elgin, Illinois.

■

A temporary injunction to prohibit the enforcement of the lard substitute (shortening) tax in South Dakota, has been granted to the Wesson Oil and Snowdrift Sales Company by the Circuit Court at Pierce, South Dakota. The new law, which would tax lard substitutes (vegetable shortenings) at 5c per pound, became effective July 1. The injunction was granted on the contention of the Wesson company that the measure is unconstitutional.

■

The Buckeye Cotton Oil Co. has recently started crushing soybeans at Louisville, now producing soybean oil as well as cottonseed oil and offering both types of meal and cake.

New Laboratory Scale

A laboratory scale, designed to permit close reading without the use of extended beam equipment, has recently been perfected by the Toledo Scale Company, Toledo, Ohio. The chart on this scale has a capacity of 500 grams, with a mark and figure for each gram. It also shows the avoirdupois equivalents. Additional capacity up to 5 kilograms may be secured by the use of weights.

This scale is so designed that the oscillation ordinarily found in extended beam type scales is eliminated. The chart housing may be set at any convenient angle, and the scale comes equipped with either a pan, platter or scoop as the purchaser desires. It is finished in grey baked enamel which is easily kept free from dust and dirt. This scale is for use, primarily, in industrial research laboratories. It will be a great aid to research engineers as it enables them to weigh ingredients accurately, to the gram, in approximately one quarter the time consumed with balance equipment.

■

The Federal Trade Commission resumed its hearings in investigation of the cottonseed industry in Shreveport, Louisiana, on Wednesday, July 29th, in the Chamber of Commerce Building. In compliance with two Senate resolutions the Commission has held hearings in various southern cities in the last year, in an investigation of the cottonseed situation. Volumes of testimony have been adduced at these hearings, but arrival at definite conclusion seems remote.

■

General Foods Corporation, Best Foods, Inc., and Kraft-Phenix Cheese Corporation have renewed their memberships in the Mayonnaise Manufacturers Association.

At a recent general conference of all interests affected, the simplification program on glass containers for mayonnaise, salad dressing and sandwich spread was approved for recommendation to the mayonnaise industry.

The conference voted to reduce the number of sizes of glass containers from 25 to 5, and to standardize on liquid measure as the gauge of contents. The five sizes recommended by the conference are the 3 fluid ounce, the half-pint, pint, quart and gallon. It is noteworthy that this simplification program will not affect the distinctive shapes of containers in use by different manufacturers.

Record Earnings for Procter

The annual report recently issued by the Procter and Gamble Company for the twelve months ended June 30 showed net earnings of $22,658,018, which was compared with earnings of $22,450,000 for the previous fiscal year.

The increase in net earnings was achieved despite a falling off in gross sales, which were $190,523,237, as compared with $203,305,610 for the previous year. It was pointed out in the report that the decrease in gross sales did not result from a lower volume of business measured in tonnage, but from the steady decline in sales prices during the period. Total assets of the company show an increase of $13,149,073, being reported this year as $169,027,631, as compared with $155,878,554 in 1930.

■

A cable communication from Trade Commissioner Ehrhardt at Mukden, Manchuria, states that June and July shipments of Manchurian soybeans show large increase southward to Dairen with corresponding falling off of shipments to Vladivostock reported due to shortage of coolie labor at Vladivostock and withdrawal of several shipping companies from that port.

■

Margarine Tax Amendments

Amendments to the margarine tax regulations to conform with the new definition of margarine which includes so-called cooking compounds have been issued by the Bureau of Internal Revenue. The regulations are under the Haugen law, approved July 10, 1930, to take effect twelve months later. The law amends the legal definition of margarine to include within the tax a number of preparations sold as cooking compounds but alleged to be used as butter substitutes and which were the cause of much litigation in attempts to escape the tax.

The regulations are drawn in detail to include all products which might be used as butter substitutes but to exempt puff pastry shortenings, salad dressings, liquid emulsions, pharmaceutical preparations, oil meals, liquid preservatives, illuminating oils, cleansing compounds, and flavoring compounds. In case of doubt, collectors are to forward samples to Washington for analysis.

■

According to a recent ruling of the Treasury Department, the use of hydrogenated whale oil is now permitted in margarines made and sold in the United States.

English Seed and Oil Values

At the end of June, the average index of oilseeds stood at one point better than in January, being 76% of the pre-war average taken as 100. There was a slight gain during February, but this was not held although a rally in June brought the average back seven points from the low of the year, or 69% pre-war average. Soybeans reflected a net loss of one point for this six months period, while undecorticated peanuts registered a gain of 18 points. Plate linseed in June went to about 7 points above the January average.

The average for oils and fats in June was two points under the January average. A notable loss was that of Danish butter, the index value of which fell from 110 in January to 90 points in June. Coconut oil lost 11 points and African soft palm oil 7 points. Most of the other items showed gains. Oil cake showed a net loss, averaging a lower index of two points for the six months period, the chief losses being on 9% linseed down 13 points while Egyptian cottonseed cake was up 4 points. Soybean meal climbed 3 points.

■

Largest Whaler Completed

From the shipyard of Workman, Clark & Co., Belfast, Ireland, the 34,000 ton *"Kosmos II"* was launched on July 7. The ship is designed for the Antarctic whaling trade and is the largest whaling vessel now afloat on the high seas. The boat is larger than many of the ocean greyhounds and is equipped with the latest devices for whaling, and reduction of the carcasses. It is a combined factory and tanker and with thirty-three large tanks holding a total of 25,000 tons of whale oil. The new machinery will be able to handle the carcasses and extract oil up to 2,500 barrels daily. She has accommodations for 300 men aboard, including the crews of seven killer boats which will make up her fleet. As originally laid down and planned the *Kosmos II* was to enter the Antarctic whaling trade this fall, but owing to the agreement to keep the whalers tied up at their ports in Europe, she will proceed to Norway and lie idle for a year, leaving for the Antarctic in July, 1932.

■

Evans A. Sigworth, of Industrial Chemical Sales Company's New York office, was married on June 24th to Miss Mary A. Bigely at Spruce Street, Pennsylvania. Mr. and Mrs. Sigworth will make their residence in New York City.

ABSTRACTS

David Wesson, Abstract Editor

In a suggested method for the determination of crude protein in feedstuffs, copper sulfate is substituted for mercury in the Kjeldahl analysis. One gram of material is heated with 5 grams of copper sulfate crystals, 15 grams potassium sulfate and 20 cc. sulfuric acid until the solution has a clear green color (about ½ hour). The solution is heated for ½ hour longer and distilled in the usual manner with sodium hydroxide. *Landw. Vers.-Sta.* 111,159-61, *Chem. Abstr.* 25,3096 (1931).

■

The nitrogen distribution in cod liver is said to be: protein nitrogen 84.1%, non-protein nitrogen 16.9%, water-soluble total nitrogen 25.0%, water-soluble protein nitrogen 9.1%. *J. Agr. Chem. Soc. Jap.* 6,927-9, *Chem. Abstr.* 25, 3042 (1931).

■

In the synthesis of fatty acids from hydrocarbons, the latter are oxidized for fatty acids by means of oxides of nitrogen or by nitric acid and the product of the oxidation is submitted to a temperature below 300° C. or to a reduction, preferably in the presence of catalysts or under high pressure, or both, before the final distillation. Fr. Pat. No. 697,595.

■

Pure lignoceric acid has been prepared from oil expressed from the seeds of *Adenanthera pavonina*. The seeds yield 14% of fixed oil, and the pure lignoceric acid yield was equivalent to 1.5% on the seeds.

■

In experiments on the hydrogenation of the methyl ester of linolenic acid, it has been shown that, in hydrogenation with one molecule of hydrogen, the double bond 12,13 is first saturated, forming the 9.10,15,16- linolic acid, then by a partial shifting of these double bonds, a quantity of the isomeric 10,11,14,15- linolic acid is formed. In hydrogenation with two molecules of hydrogen, the newly formed 10,-11,14,15- linolic acid saturates its 14,15 bond, forming a 10,11- elaidic acid; the 9,10,15,16-linolic acid saturates its 15,16- bond and should therefore form the normal 9,10 oleic acid, but instead the 9,10 bond is shifted to 8,9 and possibly in part to 10,11 forming isomeric oleic acids. *Chem. Umschau Fette, Oele, Wachse u. Harze* 38,89-96 (1931).

Fats and waxes are atomized and coated with a harmless powder such as flour to prevent agglomeration and keep them in an easily used form as ingredients for cakes, confectionery and the like. Fr. Pat. No. 697,572.

■

Products for use in the textile, linoleum and rubber industries or as additions to varnishes, etc., are made by polymerizing vegetable oils or fats or their derivatives in the form of emulsions, small quantities of sulfur or oxygen or compounds liberating sulfur or oxygen being used as accelerators. Fr. Pat. No. 697,785.

■

Soft fat or liquid oil may be manufactured from solid fats by the action of the silent discharge against the fats in vacuo or in an atmosphere of nitrogen or hydrogen. Jap. Pat. No. 90,175.

■

In forming products suitable for compounding with rubber latex, a water-soluble volatile base soap of a higher aliphatic acid, such as ammonium stearate, is first mixed with a filler such as carbon black, in a finely divided form, which is nonreactive with the acid, the mixture is mixed with a rubber latex, and the soap is then reconverted into the original fatty acid, suitable by removing ammonia in a drying operation. U. S. Pat. No. 1,798,253.

■

Solvents and emulsifying agents for fatty materials and mineral oils are made by adding olein or its equivalents to a mixture of soaps or soap equivalents (such as aromatic or hydroaromatic sulfonic acids or their salts), with alcohols of high molecular weight.

■

Referee Applicant: A. G. Hayes, of Memphis, Tennessee, has applied for Referee Certification for all products covered by the rules of the National Cottonseed Products Association, (First publication).

■

Clifford T. Weihman, Smith-Weihman Co., vegetable oils, New York, has been elected to membership in the New York Produce Exchange.

Kapok Oil

(*From page* 305)

In all these tests, the color developed by the kapok oil is much deeper than that developed by the same percentage contamination of cottonseed oil. Further, the color produced by any given mixture with kapok oil is equivalent to that given by mixtures containing cottonseed oil in quantities ten or more times as large as the particular kapok admixture. Mixtures of oils containing cottonseed oil in amounts of 5% or more give colors of such deep red, that the depth of color is of very little value, as indicating the percentage of contamination. This is also true of kapok mixtures containing 1% kapok oil, or more.

These tests, of course, were made on cottonseed oil, which had not been subjected to any heat that would vitiate the Halphen reaction.

■

Solvent Specifications

(*From page* 312)

The fact that the temperature of extraction determines the amount of extracted material obtained leads to some interesting conclusions regarding the determination of oil in cottonseed products by different laboratories. In South Texas, cottonseed start moving in July. Therefore, the laboratories have to make analyses during the hottest part of the year. The petroleum ether which has been used contains a large amount of iso-pentane quickly lost when extracting in hot weather, necessitating the refilling of the extraction flask two and three times, thereby materially increasing the amount of hexane in the solvent, which would tend to give a higher percent of oil than that obtained by laboratories operating in cooler climates.

Complaint was made against the oil results obtained by one laboratory being materially higher than those obtained by another laboratory, both using the same petroleum ether and operating in the same city. On investigation, the fact was found that the laboratory obtaining the lower results was using a Smalley extraction tube, while the other laboratory was using a Butts tube. Both tubes are of the percolating type, but the Smalley tube has a side arm which carries the hot vapors of the solvent direct to the condenser without the vapors coming in contact with the material being extracted, which contact does occur in the Butts tube. On substituting a Butts tube for the Smalley tube, the results obtained by the laboratory obtaining the lower results checked the results obtained by the laboratory obtaining the higher results. The conclusion was reached, independent of the work of this committee, that the differences between the two laboratories was due to the difference in temperature at which extraction occurred.

A number of the samples of cottonseed which had been extracted at a temperature of 80° C., to obtain the results given in Table V, were re-extracted in the ordinary manner. The material extracted was solid and reddish-brown in color, apparently of a resinous nature.

Conclusions

THE solvent used should be of the pentane type, containing a minimum amount of iso-pentane, iso-hexane, and hexane. The following specifications would give a product meeting the above requirements:

Initial boiling temperature	—not less than 35° C.
" " "	— " over 40° C.
Dry flask end point	— " " 60° C.
" " " "	— " less than 50° C.
At least 95% distilling under	—55° C.
Not over 85% " "	—40° C.
Specific gravity at 60° F.	—.630 to .675
Color—water white	
Evaporation residue—not over .002% by weight	
Doctor test—sweet	
Copper strip corrosion test—non-corrosive	
Unsaturated compounds—trace only permitted	

This product would have approximately the following composition:

Iso-pentane	0% to 5%	or about	2%
Normal pentane	70% " 85%	" "	80%
Iso-hexane	5% " 20%	" "	9%
Normal hexane	5% " 20%	" "	9%

■

Linseed Crush

According to preliminary figures of the Census Bureau there were 25 mills in the United States which crushed flaxseed during the quarter ending June 30, 1931, reporting a crush of 201,223 tons of flaxseed and a production of 130,324,839 pounds of linseed oil. These figures compared with 203,568 tons of seed crushed and 130,863,405 pounds of oil produced for the corresponding quarter in 1930, and 278,933 tons of seed and 187,018,538 pounds of oil in 1929.

Stocks of flaxseed at the mills on June 30, 1931, amounted to 33,535 tons, compared with 65,173 tons for the same date in 1930 and 100,928 tons in 1929. Stocks of linseed oil reported by the crushers were 47,156,191 pounds on June 30, 1931, compared with 71,222,982 pounds for the same date in 1930, and with 83,544,918 in 1929.

OIL & FAT INDUSTRIES

The Editor's Page

Management or . . . Muddling

NEWSPAPERS and general magazines throughout the country have cited one of our largest vegetable oil refiners and soapmakers as the outstanding example of a business so planned as to avoid the unfortunate consequences of sporadic unemployment in the ranks of the workers, whether caused by seasonal of cyclic business depressions.

We are reliably informed that the manufacturing plants of the company referred to are operating at or near the peak of capacity in all departments. This fact appears, to us, to point a lesson to other manufacturers in all divisions of industry, and to all bankers as well.

In reviewing the growth of American manufacturing enterprise, we note that, in the early days of the republic, most industrial plants were conducted very much on family lines. The soapmaker or the tallow chandler furnished lodging and food to his apprentices and journeymen, as well as wages, and his contracts with these employes were such as to make him responsible for their maintenance for a period of years, regardless of the fortunes of his business.

With the growth of the corporate system, and in later years, our insatiate pursuit of the fancied economies supposed to be gained by mergers and combinations, this responsibility of the employer toward the worker has been almost entirely forgotten. The managers of most of the large combinations do not hesitate to expand facilities beyond all reason in times of increasing prosperity, with the inevitable result of suddenly being forced to deprive thousands of employes of their livelihoods at the first approach of recession in demand.

In contrast with such inept procedure, we note the management of the organization above referred to, as well as many other able and far-sighted manufacturers, planning their operations of production and distribution along sane average lines, for two, three, or even five years in advance; developing their sales, sales promotion and research departments in such manner as to insure the healthy growth desired; thereby maintaining a satisfied staff of skilled workers, free from the twin specters of unemployment and want.

Great size is no barrier to such intelligent planning, but we cannot help believing that the lack of such procedure on the part of many of our industrial giants is in large measure responsible for the extreme length of the present "quiet business" period.

■

Production Only Deferred

THE Bureau of the Census figures for production, factory consumption, import and export of animal and vegetable oils during 1930, which were published in *Oil & Fat Industries* in August, reveal some very interesting facts in relation to the trend of the industry during a period of extreme depression and falling prices.

The most startling single feature was a sensational reduction in output of linseed oil, without any compensating increase in imports; in fact the imports showed a slight decrease as well. This marked slump in production of the leading surfacing raw material indicates an undoubted slowing-down of construction and maintenance work throughout the country, of homes as well as of business and industrial buildings. In all the light of past experience, it can mean only an acceleration of demand in the same line when confidence is once again restored and the nation starts moving forward to overtake the normal gain in demand from increased population and increased useful wealth.

None can deny that even in times of depression useful wealth (the products of mines, mills, and forests) continues to increase. That the value is temporarily lessened by a periodic slackening of demand does not in the least imperil the existence of this wealth which has been wrested from the earth by man's labor, and which will remain as a basis for capital and credit.

The falling off in demand for edible fats has been not so great as that in the technical oil field, and the recovery may be expected to be less sudden. The necessity for fat in the diet is such that even when the family budget

is curtailed, an appreciable proportion must be allotted for fatty foods.

One of the most interesting elements is found in the continuance of the soap industry's demands for fats and oils. Comparative poverty and unemployment evidently cannot conquer the native urge cleanliness of the American population.

■

A. O. C. S. Bowling Tournament

The twelve fastest and smoothest alleys in the city of Chicago, at 235 South Wabash Avenue, just around the corner from the Congress Hotel, have been secured for the Second Annual Bowling Tourney of The American Oil Chemists' Society, October 29th.

Play will be resumed for the Nuchar Challenge Trophy Cup, won last year by the Amaizo team of The American Maize Products Co., and this year the eligibility rules have been so tightened up that a good stiff competition, in doubt to the last minute, is assured.

All contestants must be actually employed in the chemical laboratory or in some department of the plant where actual processing of fats, oils or soaps is done, and at least one member of each team must be a member of The American Oil Chemists' Society, in good standing. Exhibitors at the convention are also eligible for competition.

In addition to the Nuchar Challenge Trophy, herewith shown, there will be several other prizes, including individual high single game, and high three games, also illustrated.

One of the most dangerous teams last year was the Procter and Gamble team of Cincinnati, and we understand that, in spite of extreme heat, this team has started preliminary practice on the Wyoming alleys, headed by President Richardson of the Society. They will be a hard team to beat this year. They are all eligible.

The Armour team will bear watching this year, as they turned in the highest single game of the year last year and we hear that John Vollertsen has had them out practicing regularly. The Swift Premiums form one of the best teams we have ever seen in competition. They play together regularly and will be close up at the finish as they were last year. Irwin will be a factor this year, even though he had hard luck last year.

The "Dark Horse" team of the race is said to be the Wilson team. They didn't get to "clicking" last year, but watch them go this year. Tolman is in the pink of condition, and

A. O. C. S. Bowling Challenge Trophy

promises to show the boys some real rolling. It's going to be a lot of fun. We guarantee plenty of alleys and lots of good clean fun this year. Come in and meet your competitors and your friends on the alleys, and have a lot of real sport.

There'll be a surprise entertainment too, that will be the talk of the meeting. You'll be sorry if you miss it. We are planning to meet at the hotel at six-thirty and have dinner in the balcony of the Pine Room, and go from there in a body to the alleys.

Send in your reservations early for team and personal bowling to John P. Harris, 205 W. Wacker Drive, Chicago, Chairman of the Bowling Committee.

■

Position Wanted: *Chemist*—Has recently developed a new process for decolorizing and bleaching beeswax, also applicable to some oils and fats; desires permanent position. Address Box No. D71, *Oil & Fat Industries*, 136 Liberty Street, New York City.

■

Position Wanted: *Manager*—Sales Manager or General Manager, margarine, compound, salad oils, coconut butters, any edible fats. Address Box M52, *Oil & Fat Industries*, 136 Liberty St., New York.

Rancidity and Stability in Shortening Products

Discussion of the Phenomena of Rancidity and Instability with a Review of Proposed Methods of Testing Fats for Rancidity*

By W. O. Pool†

RANCIDITY may be divided into three general types—ketonic, hydrolytic and oxidative. We are concerned principally with the oxidative and to a minor degree with the hydrolytic rancidity. Rancidity may be defined, in a restricted sense, as the condition produced in a fat by the formation of those substances which possess a characteristic, disagreeable odor and taste. In a broader sense, rancidity might be conceived as a condition of a fat resulting from a host of changes occurring in the fat under both abnormal and normal conditions. The original molecules are broken into simpler compounds, giving rise to at least twenty and probably many times that number of new compounds. It is very likely that the typical odor and taste of a rancid fat is due to only a few of these new bodies, but the actual condition which accompanies the rancid flavor is certainly the resultant of every change which has occurred in the process.

The ideal test for rancidity, broadly defined, would measure the average result of each weighted change that has taken place in the fat, while the ideal test for rancidity in a restricted sense would measure only those substances which cause the rancid taste and odor. But, with such a vast number of changes and with each change taking place at a varying speed, the ideal test must remain only an ideal.

The next best test would be one which would measure a single substance or group of substances which invariably accompanies rancidity, and whose amount is proportional to the degree of rancidity. Unfortunately, the percentage of the substances which are known to be present in all rancid fats seems to vary with many factors other than the state of rancidity. Nevertheless, it is tests of this sort on which we must rely for confirmation of taste and odor. It would be well to review these briefly, and to examine the basis on which each test stands.

Effects of Rancidity

OF THE many changes occurring in rancid fats, that of change in acidity is one of the most striking. Ritsert[1] in 1890 and Spaeth[2] in 1896, used the increase in the free fatty acid as a measure of the process of rancidity. In 1900, however, Reinmann[3] found that there was no direct relation between the amount of acid formed and the extent of rancidity. Since that time, it has been conceded that the acidity of a fat cannot be used to recognize rancidity. The behavior of the acid content of a fat is more dependent upon other factors than upon oxidation.[4,5,6,7] Moisture, in particular, will promote hydrolysis, and the increase in acid content will proceed at a much more rapid rate than oxidation. Holm and Greenbank,[8] in 1924, observed that in the absence of moisture oxidation of fats proceeds only to the aldehyde stage. Consequently, in the latter case, we should obtain a rancid fat which would be very low in acidity. Kerr and Sorber[9] state "that if a clear sweet fat is allowed to develop rancidity and the free acid is determined at regular intervals, it will be noted that during the first few weeks the percentage of free acid remains stationary or perhaps shows a slight increase; then a sudden drop is noted, the percentage of free acid falling off 0.2 to 0.4% or even more. Coincidently, the physical signs of rancidity appear. Following this reduction in the percentage of free fatty acid, there begins an increase in acidity." The same workers, however, concluded that acidity and rancidity do not, in general, bear any relation to each other and that the determination of the free fatty acid is worthless as a criterion of rancidity.

Oxidation of an unsaturated compound usually results in a rupture of the double bond, consequently the iodine value of a fat should undergo a decrease with the development of

* Presented before American Oil Chemists' Society.
† Research Laboratory, Armour & Co., Chicago.

rancidity. This is actually the case, but the difference in the iodine value of the fresh and rancid samples is too small to be of any service in the recognition of rancidity.

When the long chain acids of a fat are broken down by oxidation, acids of lower molecular weight are formed. Saponification numbers of rancid fats are therefore greater than those of

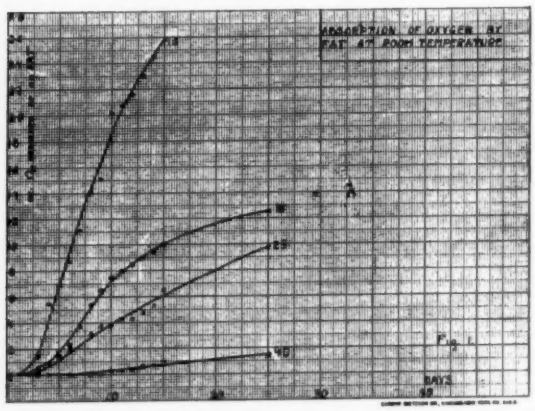

Fig. 1

fresh fats. The variation, however, is insufficient to be employed as a criterion of rancidity. In the process of going rancid, the relative amount of unsaponifiable matter increases, the heat of combustion decreases, due to slow oxidation, while the specific gravity and viscosity of a fat increase. None of these changes are simple enough or significant enough to enable us to use them as a means of detecting rancidity.

Formation of Peroxides

IN 1915, Vintilesco and Popescu[10] observed that acidity is not a necessary accompaniment of rancidity. From this fact they deduced that fats could undergo an additive reaction with molecular oxygen without suffering hydrolysis with formation of free acids. They reasoned that the additive compound formed would probably be of a peroxide nature, and ought to be quickly displaced by easily oxidizable substances. Such was found to be the case. Rancid fats were reduced by a tincture of guaiac and a peroxidase. Fresh fats were unreactive, but after a comparatively short exposure to air, became reactive. Vintilesco and Popescu concluded from these experiments that the presence of a loosely combined form of oxygen was the chief characteristic of all rancid fats. This conclusion has been confirmed and extended by Kerr and Sorber[9]. Other workers[11,12,13] have used variations of such a procedure in order to measure the amount of peroxides in a fat. None of the methods, however, give quantitative checks in the hands of different analysts and all but the freshest fats give a positive test.

In 1920, Fahrion[14] devised a method for the determination of rancidity, founded upon the following facts:

Fresh fats have a negligible amount of hydroxy acids, but upon oxidation of the fats these acids are formed in considerable quantities, depending upon the extent of the oxidation. Once formed, the hydroxy acids are very stable and do not suffer a decrease due to volatilization. Based upon the insolubility of the oxidized acid in petroleum ether, Fahrion used the following procedure for their determination:

Three grams of the fat were saponified with alcoholic potash, and the alcohol was driven off by evaporation. The soap was dissolved in 50 to 70 cc. of hot water, and transferred to a separatory funnel. When cooled, 100 cc. of petroleum ether was added. The solution was acidified with hydrochloric acid, and shaken and allowed to stand overnight. The water solution was then drawn off and the petroleum ether filtered. The precipitate of oxidized acids was washed with petroleum ether several times and dissolved in the smallest possible amount of warm alcohol. The alcohol solution was transferred to a tared dish, the alcohol evaporated off and the oxidized acids weighed. The temperature was not allowed to exceed 95° C. The amount of oxidized acids varied

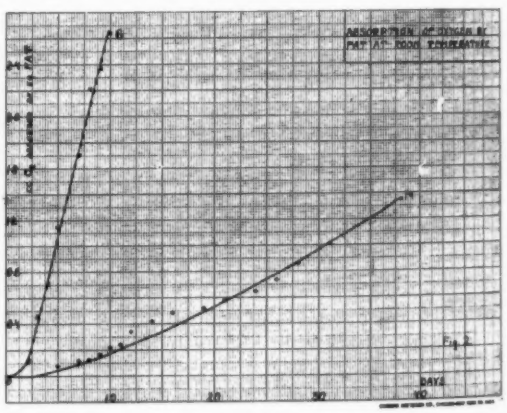

Fig. 2

from mere traces in fresh fats to about 28% in extremely rancid fats. All non-volatile acids of a thirty year old cottonseed oil were found to be hydroxy acids[15]. Results by this method are easy to duplicate but little work has been done toward determining the exact relationship between the amount of hydroxy acids in a fat and its condition with regard to rancidity.

Issoglio, Kreis and Kerr

IN 1916, Issoglio[16] devised a test for rancidity, depending upon the presence of easily oxidizable and volatile substances in rancid fats. As a means of separating these bodies from the sample being tested, he employed steam distillation, using a standard solution of potassium permanganate to receive the oxidizable compounds from the fat. Back titration with standard oxalic acid solution enabled him to calculate the amount of permanganate which had been used in oxidizing the substances distilled from the fat. He expressed his oxidizability value as the number of milligrams of oxygen required to oxidize the organic compounds distilled from a standard amount of fat. The results checked fairly well and an oxi-

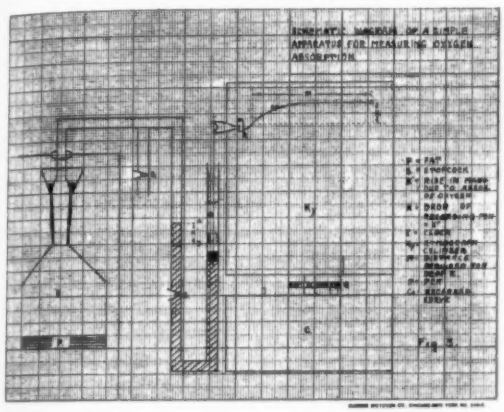

Fig. 3

dizability value, greater than 15, is confirmatory evidence of rancidity.

Kerr[17] modified the Issoglio procedure and used extraction with boiling water in order to separate the oxidizable substances from the fat being tested. The latter method has several advantages over the former and gives results which are just as consistent. However, the oxidizability value seems to behave very erratically in an aging sample of fat. Kerr found that on exposing a sample of fat to the air that the Kreis test became more intense at an increasing rate, but that the oxidizability number of the same sample had an initial value of 7, and later fluctuated between 7 and 13, and upon final analysis was approximately equal to 9. More work is necessary upon this test before its usefulness as a criterion on rancidity can be definitely determined.

The most widely used method for the detection of rancidity in fats is that devised by Kreis[18] in 1903, and later improved by Kerr. The Kerr procedure[17] is as follows:

10 cc. of the suspected fat are placed in a test tube or bottle and 10 cc. of concentrated hydrochloric acid are added. The tube is stoppered and shaken vigorously for approximately thirty seconds. 10 cc. of a 0.1% solution of phloroglucinol in ether are then added and the tube is closed, shaken, and allowed to stand for a few minutes. A red or pink color in the acid layer indicates a positive reaction. The Kreis test is expressed as a number which is a measure of the amount a fat must be diluted with a non-reacting solvent in order to give a negative result under the above conditions. The accuracy of the Kreis test, as a measure of rancidity, is very doubtful. In 1918, Kerr stated that a Kreis test greater than 20 represented fats which had definitely become rancid, and that the intensity of the test was roughly proportional to the rancidity. However, he added

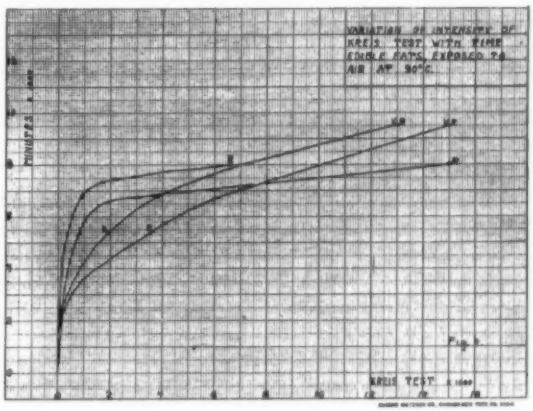

Fig. 4

that the Kreis test was too delicate to be used alone as a criterion of rancidity, and that it was not specific for rancid fat.

Holm and Greenbank[19] in 1923 found that the intensity of the Kreis test of oxidized butter fat and lard was proportional to the amount of oxygen absorbed. These workers concluded, however, that although intensity of the Kreis test is a measure of oxidation, it has no direct quantitative relation to the degree of rancidity as measured by the olfactory sense. The reaction producing the colored compound on which the Kreis test is based has been ascribed to the condensation of phloroglucinol with various substances occurring in the rancid fat. It remained, however, for Powick[13] to definitely prove that the pink or red color indicating a positive Kreis test was due to a compound formed from the phenol and epihydrin aldehyde. This aldehyde, which is very unstable, does not exist as such in the fat. It is probable that in a rancid fat there is a parent substance in the form of an acetal which, upon treatment with an acid, decomposes to give the short-lived epihydrin aldehyde. A diethyl acetal of epi-

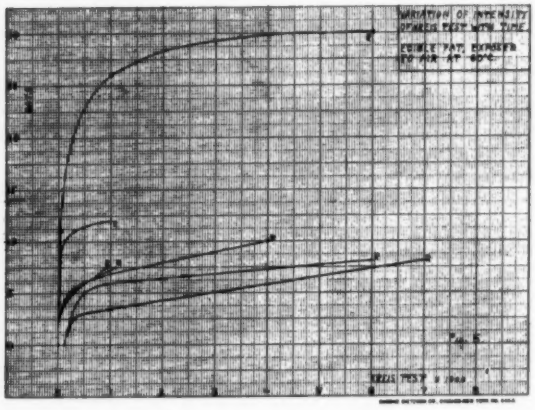

Fig. 5

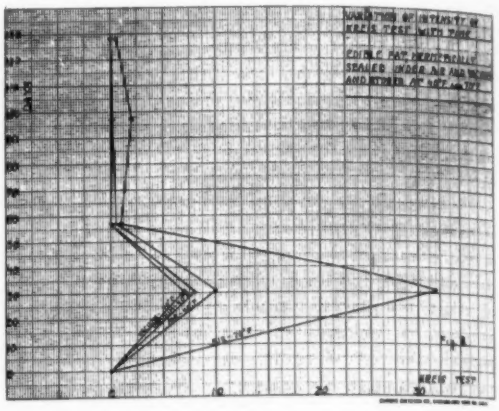

Fig. 6

hydrin aldehyde synthesized by Powick gave a Kreis test which was spectrographically identical with the positive test given by a rancid fat. The basis of the Kreis test is seen, therefore, to rest upon the unproved assumption that an acetal of epihydrin aldehyde occurs in all rancid fats in an amount which is proportional to the degree of rancidity. The status of the Kreis test is at present uncertain. Although it has been rejected by many scientific investigators as a means of detecting rancidity, it is still finding wide use commercially. The final report of the Kreis Test Committee will, no doubt, settle the very puzzling question as to the validity of the test in the determination of rancidity.

Stability

THE stability of a fat might be said to be the resistance which a fat offers to oxidation or to those changes which promote rancidity. It is a variable property whose origin is thought to be due to the comparatively low reactivity of glycerides with oxygen and to minute amounts of substances in the fat which act as negative catalysts to oxidation. All of the tests for stability depend in their final analysis upon the determination of the rate of oxidation. This is sometimes measured directly as in the oxygen absorption tests,[19] but usually the determination is of a very indirect nature as in the Bailey[20] test. The ordinary holding test for the determination of the keeping quality of fat, in which a sample is placed in a container and allowed to become rancid under ordinary conditions, has the disadvantage of requiring too great a length of time for completion. In some cases months might be required for information needed within days. Consequently, the process must be hastened without greatly changing those reactions which cause rancidity. This could easily be accomplished by elevating the temperature, by increasing the concentration of the oxygen or by increasing the surface at which the oxidation occurs.

Schaal of the Technical Bureau of the Biscuit and Cracker Manufacturers' Association devised such an accelerated test for stability which gives excellent results. 100 grams of a sample of fat are placed in a beaker and kept at an elevated temperature until it possesses a definitely rancid odor. The temperature usually used is 60° C. and the time required for the fat to become rancid at this temperature varies from four to more than forty days. By the use of this test, four unknown samples were classified with regard to their stability by five different laboratories with almost perfect agreement. Checks on the same samples are rather close, and the variation is very great between a fat of high stability and one of low stability. The two most serious disadvantages of this method are the large personal error, and the questionable effect of minute amounts of the volatile products from one sample upon an adjacent sample. A minor objection is the length of time required by fats of high stability to become rancid. Nevertheless, the test is finding widespread use at the present and is to be recommended as one of the best stability tests we now have.

Variations of such temperature accelerated tests for stability are many. Richardson increases the acceleration by using Petri dishes instead of beakers, thus offering a greater surface at which the oxidation could occur. Wesson achieved the same result by distributing the sample under investigation upon absorbent cotton. Bailey[20] went one step further by passing a current of air over the heated fat. His method, however, differed fundamentally from the previous tests in that organoleptic tests were not used for determining the completion of the reaction. His procedure is as follows:

Air is drawn at a definite rate over 3 grams of fat, evenly distributed upon a standard size filter paper, maintained at a constant temperature of about 90° C. The air is then passed into a modified solution of Schiff's agent which possesses the property of turning pink in the presence of aldehydes. The time required for the first appearance of this color is taken as an indication of the susceptibility of the fat to rancidity.

Bailey found the test useful in determining which of two fats would remain sweet the longer. In its present state of development it is merely comparative, and every batch of samples must be run with a control of proven quality. Wesson[21] has done some work with the Bailey test and states that tests made in the oven closely confirm the results of the Bailey stability test.

The oxygen absorption test measures the time required for a definite quantity of fat to absorb a specified volume of molecular oxygen. This is accomplished by placing the sample in a closed system, at some constant temperature, and measuring the absorption of the gas by the decrease in pressure within the system. The method was originated by Holm and Greenbank in the Bureau of Animal Industry, and in their hands, gave very consistent results. Since that time many workers have confirmed the reliability of the results obtained by this procedure as a measure of stability of edible fats. The working temperature is generally about 90° C., and the time required by the fat to absorb 30% by volume of oxygen is generally taken as the oxygen absorption value. This time will vary from three hours for a fat of very low stability to over sixty hours for a fat of extraordinary stability. If the fat is agitated or if the working temperature is increased, the oxygen absorption values become correspondingly lower. Oxidation is also greatly accelerated if pure oxygen or ozone be used instead of air as the oxidizing medium. This test is excellent as a means of measuring the keeping quality of edible fats, but due to the initial cost of the apparatus it is doubtful if it will ever find very widespread use except in research work.

Explanation of Figs. 1 - 8

FIG. 1 shows the rate of oxygen absorption at room temperature by four edible fats. The figures terminating the curves are the number of days required by the fat to become rancid under the conditions of the Schaal Test.

Fig. 2 represents the same sort of experiments shown by Fig. 1. Each curve is an average of four separate experiments on the same fat. As before the terminating figures of the curves are results of the Schaal Tests on the corresponding fats.

Fig. 3 is a schematic diagram of an apparatus for the rough determination of the oxygen absorption value of a fat.

Figs. 4 and 5 show the increase of the value of the Kreis test with time. Samples in these experiments were exposed to air. Points at which rancidity occurred are denoted by "R" on each curve.

Figs. 6 and 7 represent the increase of the intensity of the Kreis test when the samples are exposed to a limited amount of oxygen. The curves in Fig. 6 are averages of six individual experiments all of which gave very similar results. Each curve in Fig. 7 is an average of four experiments.

Fig. 8 consists of two generalized curves, one based on data from Figs. 4 and 5 and the other derived from inspection of Figs. 6 and 7. The two curves in Fig. 8 are not drawn to scale with respect to one another.

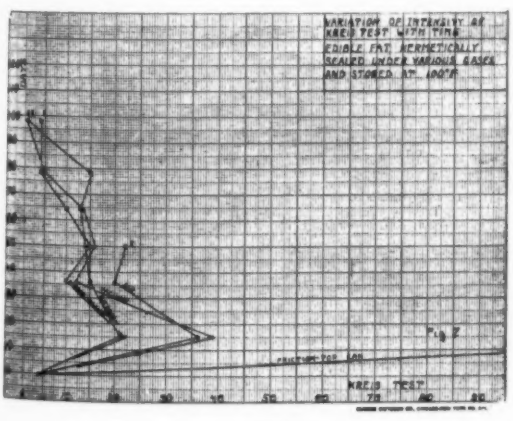
VARIATION OF INTENSITY OF KREIS TEST WITH TIME
EDIBLE FAT HERMETICALLY SEALED UNDER VARIOUS GASES AND STORED AT 100°F
KREIS TEST

Fig. 7

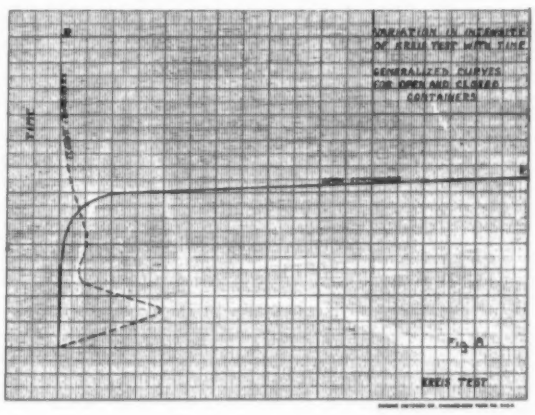

Fig. 8

Discussion of Data Contained in Figs. 1 - 8

IT IS evident from Figs. 1 and 2 that the results given by the Schaal Test are approximately inversely proportional to the speed with which a fat absorbs oxygen.

In Figs. 4 and 5 it is seen that the value of the Kreis test increases at an increasing rate if the sample is exposed to an unlimited supply of oxygen. Kerr in 1918 and Holm and Greenbank in 1923 have noted the same phenomenon.

Figs. 6 and 7 indicate that the change in the Kreis test takes an entirely different course in samples of fat exposed to only a limited amount of oxygen. In samples of fat having restricted access to oxygen, the Kreis test reaches a maximum and then begins a decrease which often results in the fat exhibiting a lower value than that it originally possessed. It is possible that this difference in type of change in the Kreis test of exposed and unexposed samples of fat might furnish an explanation of anomalous and contradictory results obtained by different workers in using the Kreis test as a means of detecting rancidity. A fat may have a negative Kreis test and be definitely rancid if it has been hermetically sealed, while the same fat may possess a comparatively high Kreis test and be non-rancid if exposed to an unlimited amount of oxygen. As many manufacturers of edible fat are placing their products on the market in hermetically sealed containers, increasing caution must be exercised in using the Kreis test in the detection of rancidity.

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10 *Vintilesco & Popescu—J. pharm. chim.*: 12, 318 (1915).
11 *Standinger—B.*: 58 B, 1075 (1925).
12 *Bulir—Chem. Listy.*: 19, 357 (1925).
13 *Powick—J. Agri. Research.*: 26, 323 (1923).
14 *Fahrion—Chem. Umschau. Fette, Oele, Wachse, u Harze.*: 16, 158 (1920).
15 *Salkowski—Zeit. Nahr. Genussm.*: 34, 305 (1919).
16 *Issoglio—Ann. chim. applicata.*: 1, 18 (1916).
17 *Kerr—Ind. & Eng. Chem.*: 15, 1051 (1918).
18 *Kreis—Verhandlungen der Naturforschenden Gesellschaft in Basel*: 15, 225 (1903).
19 *Holm & Greenbank—Ind. & Eng. Chem.*: 15, 1051 (1923).
20 *Bailey—Cotton Oil Press*: 7, No. 8, 35 (1923).
21 *Wesson—Cotton Oil Press*: 7, No. 9, 38 (1924).

Governing Committee, A. O. C. S.

The Governing Committee met May 13th, 1931, at 7:30 P. M. in Room G, Hotel Roosevelt, New Orleans, La. The Secy.-Treas. read the minutes of the last meeting, which were accepted unanimously.

Mr. Irwin submitted the following amendments to the By-Laws of the Society:

Article 5. Section A., to read as follows:

"The Society shall meet twice annually;—Spring and Fall. The Spring Meeting shall be known as the Annual Meeting of the Society; and shall be held at the same place selected by the National Cottonseed Products Association, within one week of the meeting of the National Cottonseed Products Association.

"The Fall Meeting shall be held at a place and time decided upon by the Governing Committee; and shall have equal powers as to making of rules and adoption of methods, as at the Spring or Annual Meeting.

"Due notice, of the time and place of each meeting, shall be sent to the membership by the Secretary of the Society."

Add as Article 9; Section A.:

Adoption of Methods

"Methods of Analysis offered, if adopted, shall be 'Tentative Methods', for a period of one year; after which they may be adopted as 'Official Methods', at any subsequent meeting of the Society."

On motion of R. H. Fash, seconded by M. M. Durkee, the proposed amendments were unanimously approved, to be submitted to the Annual Meeting, May 14th, 1931, for adoption by the Society. The Secy.-Treas. was was authorized to get a new supply of Moisture Dishes, and Binders for Methods of Analysis. The Secy.-Treas. was authorized to request Mr. C. B. Cluff to prepare a new supply of Official Fullers Earth; also to convey to Mr. Cluff the thanks of the Society, through the Governing Committee, for his cooperation in the past, in preparing the Official Fullers Earth.

On motion of R. H. Fash, seconded by M. M. Durkee, J. C. P. Helm was unanimously nominated as Secy.-Treas. of the Society for year 1931-1932. The Secy.-Treas. was instructed to write all members of the Society, with the aim of starting and maintaining a permanent mailing list for distributing revisions of methods each year, at a cost to each subscriber not to exceed 50c per year. On motion of R. H. Fash, seconded by M. M. Durkee—a unanimous vote of thanks and approval of all acts as President, was given Mr. W. H. Irwin; and the Local Committee of the Annual

(*Turn to Page 357*)

Oil Chemists Plan Autumn Gathering at Chicago

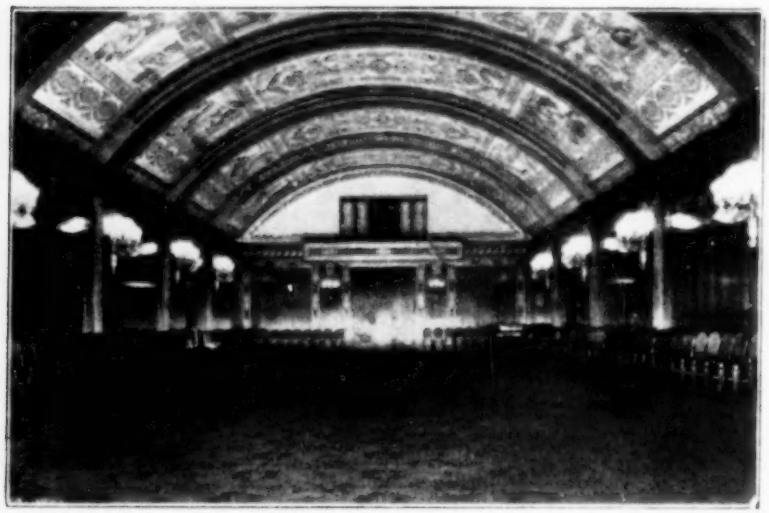
Record Attendance and Instructive Symposium of Technical Papers Expected at Midwest Gathering in October

Promenade Lounge, "Peacock Alley," Congress Hotel, Chicago

W. H. IRWIN, Chairman of the Chicago Committee on Arrangements for the Fifth Annual Fall Meeting of the American Oil Chemists' Society, announces that the program for the meeting is being completed rapidly. Many interesting addresses and papers have been submitted for presentation and others are in course of preparation. Members or others who desire to present papers to the meeting are requested to communicate promptly with President A. S. Richardson, Procter & Gamble Co., Ivorydale, Ohio, or with Mr. Irwin, in care of Swift & Co., Union Stock Yards, Chicago.

The Congress Hotel, where the meeting will be held, is making especially attractive rates for those attending, and all who expect to be present are urged to write at an early date to the Congress Hotel, Chicago, for reservations.

A special innovation in connection with the meeting will be a group of exhibits by manufacturers of and dealers in equipment and supplies for oil and soap plants and laboratories. The meeting will be held in the large Florentine Room, where ample space will be available for exhibit purposes. Some of the chemical and equipment supply houses promise unusually interesting exhibits. This will give an opportunity for every visiting and local chemist and chemical engineer thoroughly to investigate the exhibits and will give the exhibitors a maximum



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Florentine Room, Congress Hotel, scene of Oil Chemists' 1931 Fall Meeting.

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opportunity to realize on the time and effort put forth by them in preparing exhibits.

There remains at this time uncontracted for only limited space available for exhibition purposes, so that it is recommended that any concern desiring to secure space send in reservation promptly to John P. Harris, 205 W. Wacker Drive, Chicago, Treasurer of the Convention Committee, who is in charge of the arrangements for exhibition. All of the space available will be advantageously located and the attention of the members attending will be especially directed to the exhibits by the officers of the society and by the committee in charge of the meeting.

There will be a nominal charge for each space regardless of location. All exhibitors are invited to participate in the convention and in the entertainment features, including competition in the annual bowling tournament.

Many of the chemical, apparatus and equipment companies who are planning to exhibit, are taking advantage of the special combination offer of exhibition space together with a full-page advertisement in the Convention Issue (October) of OIL & FAT INDUSTRIES, the Official Journal of The American Oil Chemists' Society. In cooperation with the society, MacNair-Dorland Company, publishers of OIL & FAT INDUSTRIES, are offering a full-page advertisement in the October issue of OIL & FAT INDUSTRIES together with exhibition space at the Fall Meeting for $40.00 net, inclusive.

The October Convention Issue will be mailed two weeks in advance of the Fall Meeting and will be read by chemists and superintendents of soap factories, packing plants and oil refining plants throughout the country, as well as by those who attend the meeting.

Orders for the combination of exhibit space and full-page advertisement may be sent to Mr. Harris, or to the publishers, MacNair-Dorland Co., 136 Liberty Street, New York. Copy for the advertisement should accompany the order, and to insure insertion, must reach Mr. Harris or the publishers not later than October 1.

■

A recent report from Oslo indicates that the cod fishing season that is now drawing to its close has been one of the most disappointing in recent years in the Lofoten Islands. Unfavorable weather conditions are primarily responsible but there was also a scarcity of fish. The total catch up to March 21 was 53,764 tons or 38,000 tons less than for the same period last year. The production of steamed medicinal cod liver oil on the same date totalled 25,409 hectoliters or 671,229 gallons. Livers averaged large in size and were of an unusually high fat content, ranging from 41% to 55%. Some speculative buying was developed as a result of the limited catch and smaller production of oil within the past few weeks, with somewhat of an advance in price as a result.

■

The many friends of J. R. Powell, Chief Chemist of Armour Soap Works, retired, were grieved to learn of the death of his wife on July 24th. The funeral was held from the home of the family at Streator, Illinois.

Sampling Cottonseed at the Oil Mill *

Important Laboratory Analyses Absolutely Dependent Upon Care and Accuracy Devoted to the Sampling Operations

By E. C. AINSLIE[1]

IT IS probable that during the past season laboratories connected with the cottonseed industry have given more intensive thought to the analysis of cottonseed than they have previously given in several years. Inspections of laboratories were made, exceedingly detailed instructions were issued, check samples were run and every effort was made to produce uniform results from all of the laboratories.

Such steps were entirely proper. The present plan of buying seed on analysis rests on the premise that, given the same sample, all accredited laboratories will report results agreeing within reasonable limits. The necessity for uniform procedure is plainly recognized in the 1931 Rules in which five and one-half pages were used in setting forth the details of handling, testing and reporting seed samples. More, rather than less, of these detailed instructions may be expected in the future issue of the Rules.

In contrast, one and one-half pages of the Rules contain the methods of sampling and handling the samples. As the testing laboratory is entirely dependent upon the sample received, greater emphasis on this point might produce some good effects on the minds of the industry.

While the immediate interest of most cotton oil chemists is in the sample received at the laboratory, some of them are in actual contact with the problem of car sampling and those others not in immediate contact, must be interested and informed on this problem. They will be called upon in time to resample cars, or to give sound advice to mill operators.

For the past several years, the Buckeye Cotton Oil Company has maintained a laboratory at each mill and has sampled every car of seed received at each mill during this time. Many methods of sampling have been investigated and cleaning and division of samples have been studied. Some of the findings along this line are set forth in this paper.

Sampling

THE sampling of cottonseed presents, certainly, as many problems as the analysis of the sample. No uniform method of loading cars is in use. Any car may represent a restricted, or a remarkably large acreage. Some ginners return the trash to the seed; others do not, and carelessness in loading the cars frequently adds dirt. While simple rules may be laid down for sampling the average car, real intelligence is needed for sampling all cars.

In a recent experiment, 229 cars were sampled in three ways. In each case a 50# sample was taken from holes 30 inches deep. The methods of sampling were as follows:

1. Three holes 30 inches deep, one in either end and one in the middle of the car. 2. Five holes 30 inches deep, equally spaced throughout the length of the car. 3. Ten holes were dug 30 inches deep in two parallel five hole lines.

All of the mills in the Company took part in this experiment and nearly every variety of seed was encountered. The averages were as follows:

	3 Holes	*5 Holes*	*10 Holes*
Moisture	12.12%	12.05%	12.08%
Dirt and Trash	1.94	1.97	2.00
F. F. A.	2.3	2.4	2.4

Segregating these data and using the three-hole method as a base, 74 cars running from 0% to 1.00% dirt and trash ran as follows:

	3 Holes	*5 Holes*	*10 Holes*
Moisture	11.8%	11.7%	11.7%
Dirt and Trash	.66	.69	.71
F. F. A.	2.0	2.1	2.2

Using the same method, 95 cars running from 1.01% to 2.50% dirt and trash ran as follows:

	3 Holes	*5 Holes*	*10 Holes*
Moisture	12.2%	12.0%	12.1%
Dirt and Trash	1.30	1.59	1.57
F. F. A.	2.5	2.6	2.6

60 cars running from 2.50% plus dirt and trash ran as follows:

* Presented at Annual Meeting American Oil Chemists' Society, New Orleans, May, 1930.

[1] *Buckeye Cotton Oil Company, Atlanta, Georgia.*

	3 Holes	*5 Holes*	*10 Holes*
Moisture	12.5%	12.5%	12.6%
Dirt and Trash	4.38	4.14	4.30
F. F. A.	2.3	2.3	2.3

You will notice that the averages check remarkably well for the different methods of sampling.

Large vs. Small Samples

WHILE the rule specified that a 50# sample from each car should be taken, it is not at all unlikely that some mills, not having equipment themselves with shakers and sample reducers, take only one 1,000 gram sample from a single point in the car for settlement purposes. The dangers of this practice are brought out in the following experiment.

Ten cars of seed were sampled by taking a 50# sample from three levels in the car. Three holes 30 inches deep were dug from each level. Ten one-pint samples were also taken from each level. The average of the ten pint samples agree closely with the 50# samples, but the pint samples varied from each other remarkably. The results follow:

	Moist.	*F. F. A.*
Car #1—Level #1		
50# Sample	15.6%	7.9%
Pint Sample—Low	14.8	6.5
" " —High	16.4	11.2
Car #1—Level #2		
50# Sample	16.1%	8.9%
Pint Sample—Low	14.2	5.0
" " —High	16.1	11.5
Car #1—Level #3		
50# Sample	15.2%	8.9%
Pint Sample—Low	14.2	4.9
" " —High	15.5	12.4
Car #2—Level #1	*Moist.*	*F. F. A.*
50# Sample	13.4%	1.3%
Pint Sample—Low	13.3	1.2
" " —High	14.8	2.5
Car #2—Level #2		
50# Sample	13.7%	1.7%
Pint Sample—Low	12.8	1.4
" " —High	15.0	2.4
Car #2—Level #3		
50# Sample	13.7%	1.9%
Pint Sample—Low	12.5	.9
" " —High	17.0	2.7
Car #3—Level #1		
50# Sample	16.6%	7.9%
Pint Sample—Low	14.2	5.0
" " —High	17.0	8.0
Car #3—Level #2		
50# Sample	16.5%	9.2%
Pint Sample—Low	15.3	7.5
" " —High	16.9	11.1
Car #3—Level #3		
50# Sample	16.3%	10.1%
Pint Sample—Low	15.9	6.5
" " —High	17.0	11.3

It was observed also in this experiment that the water content of the seed was lower at the top level than at the lower level with cool seed, and that the reverse occurs with hot seed. For the same reason, condensation of water, the top seed of hot cars ran higher than the lower layers in F.F.A.

All of these cars showed similar differences between the small samples, the worse the seed the greater the difference. This is not hard to understand when it it realized that there are 88,000 pints, or 22,000 half gallons of cottonseed in the average car of seed.

Care of Sample

MOISTURE should be run on the sample as soon as possible after taking, or the sample for the laboratory should be inclosed in a tightly closed can immediately after reducing and cleaning the 50# sample from the car. Approximately 500 cars were tested by taking one-half gallon samples from the bottom of three holes from which the 50# sample was taken. The moisture content of these samples were compared with the moisture content of the reduced 50# sample. Time elapsing between sampling and testing was noted. Variable losses were found depending on original moisture, humidity and temperature, and elapsed time. One hour elapsed after sampling being a maximum for safety when a 50# sample is used.

Proponents of sampling cars as they are unloaded might ponder this. Most cars are in process of unloading from two to three hours. With small lots being taken at infrequent intervals and the receiving vessel being opened and possibly closed for each lot, a loss in moisture must ensue. Along this line, though we have tested the two methods carefully, no greater accuracy has ever been found in unloading samples.

Handling Sample

DIRT and Trash Determination. By all manner of means, all mills should be equipped with similar shakers, the length, width and metal clothing, throw and speed, all being alike. Our experience has led us to adopt a roll-fed mechanical feeder operating at not more than 10 R.P.M.

Suitable slots as specified in the Rule may be obtained by cutting three holes, 1½ inches long by approximately one inch wide, in the end of the seed deck in the shaker. Directly under these holes there should be a chute leading to a sample box. The two sides and back of the slot must have a guard of metal one inch high and the size of the sample may be regulated by having one of the side guards on each slot adjustable so that the hole may be opened or closed in making adjustments. All of the holes must be the same size. This

sampler performs a dual function of sampling and mixing as shown by the following experiment:

Known mixtures of linty and black seed were made to contain 4, 8 and 12% black seed. Fifty pound samples of these were run over the shaker by weighing 100 gram portions grabbed from the sample box. The findings of these tests are as follows:—

4%	Mixture —	4%	Found —	76	Samples
8%	" —	7.7%	" —	90	"
12%	" —	11.6%	" —	86	"

The use of black seed as a criterion of mixing may be considered sound and it might be added that unless the slots in the shaker are enclosed as directed, the black seed will shoot across the bare opening and the sample will not contain a proper mixture of this important class.

In taking samples for the laboratory from the receiving box, the one-half gallon can should be filled by taking complete vertical sections of the sample without any attempt at further mixing the sample.

Accuracy of Dirt and Trash Tests

VARIOUS experiments comparing laboratory shaker cleaning with mill cleaning show that it is not possible to remove as much dirt by passing over a small shaker and subsequently picking, as the mill does from the contents of the car. The dirt and trash reported by shaking and picking represents a minimum trash content for the average car. This factor is probably not generally understood and should be emphasized.

Confirming this statement, two experiments were run at different mills. At one of these mills, weighed amounts of sand were added to perfectly clean seed. At the other of the mills, weighed amounts of typical large trash, bolls, stems, etc., were added to clean seed. These seed were then passed and repassed over the shaker.

It was found that the shaker itself never returned all of the sand to the seed, nor all of the big trash in the seed and that the amount recovered varied inversely with the amount of sand and trash in the seed. This further emphasizes the need of sending mechanically correct samples to the laboratory for their determination of additional foreign matter.

In equipping themselves for this work, the mills need not be put to any considerable expense. There is hardly any oil mill which hasn't on hand an old shaker frame, a roll feeder, pulleys and eccentrics. The shaker can be built by mill labor and in many instances placed in the mill at some point affording power for the shaker. Two inexpensive scales are then needed. One a small platform scale on which the 50# of seed should be weighed and a reasonably priced counter scale on which the dirt and trash can be weighed in ounces. A table can be easily made from which the percentage of dirt and trash can be read for each given finding in ounces of trash.

For sampling cars before unloading, a cut-down seed fork is the best sampling tool and a sack is satisfactory for handling the sample from the car to the shaker. The sack is not satisfactory where the sample will be left for any length of time. This certainly simplifies sampling enough, and it is hoped that greater uniformity in methods of taking samples will be at the service of laboratories during the coming season.

Summary

DATA are presented showing that a number of cars sampled in three different ways produce averages which are in agreement.

Data are presented showing tremendous disagreement between small samples taken from the same car.

Recommendations are made that the sample for the laboratory be enclosed as quickly as possible in an air-tight container.

An automatic sampler with data supporting its accuracy is suggested.

The necessity for mechanically divided samples for the laboratory is indicated and the failure of any shaker to perform 100% cleaning is admitted.

An outline for equipment needed for car sampling by the mills is given.

■

Rules of business practice adopted by the edible oil industry at a trade practice conference held in New York, in December, 1927, have now been accepted by the industry with changes suggested by the Federal Trade Commission.

Those rules, designated Group I as approved by the Commission, relate to such practices as use of deceptively slack filled containers; false branding of products; and packing of edible oil for resale in odd-sized or odd-shaped containers simulating in size or shape standard sized or shaped containers.

Other rules, accepted by the Commission as expressions of the trade and placed in Group II, bear on such subjects as proper packing and labeling of edible oil considered from the standpoint of trade ethics.

Report of Moisture Committee

By N. C. HAMNER, *Chairman*

WITH the advent of seed grading, the accurate determination of moisture becomes most important, due to the fact that the quantitative index is in part dependent upon two moisture determinations, one on original sample, and one on a partially dried and treated sample. With this idea in mind, the Chairman sent out to seven laboratories a sample of cottonseed which had been carefully mixed, and took the liberty of making in addition to the membership of the Moisture Committee, Messrs. Ainslie, of the Buckeye Cotton Oil Company, and Cox of Barrow-Agee Laboratories, to cooperate. With this sample went a rather long series of tests to be made with the A. O. C. S. oven, the Freas Force-draft, and the DeKhotinsky. Five laboratories cooperated but with the exception of Mr. Cox's, were not all equipped with all ovens. There was a total of some 6200 moisture determinations made. The results obtained may be summarized as follows:

The A. O. C. S. oven will give uniform results, but under full load will not get the total moisture with this class of seed in five hours at 101°. In fact, none of the ovens will. On seed containing 8% moisture the A.O.C.S. oven in .3 low (as compared with a total moisture obtained with the official oven loaded with only twelve 5-gram samples). The Freas Force-draft gave results .1 lower in five hours at 101° than when loaded with only 10 boxes. Taking the ovens individually, the A. O. C. S. gives uniform results in any part of the oven, and it returns to 101° after introducing full load varies from fifty minutes to three hours, dependent upon heating arrangement. The DeKhotinsky in five hours under full load shows a variation of approximately .4% in the moisture results obtained, being lower on the upper shelves than on the bottom shelves and also showing a variation between the left side of the oven and the right side as we stand in front and open it. The boxes on the left side show a .2% greater moisture than those on the right, the rows between these following in between. The time of regaining temperature on DeKhotinsky was from one hour and fifteen minutes to one hour and forty-five minutes—with the auxiliary adjustments made.

The Freas Force-draft gives uniform results from left to right and from bottom to top, and in one case time of recovery of temperature is reported as "nil" and in another—45 minutes, under full load. In a test plotting temperature of ovens under full load with adjustment of heating medium, the A. O. C. S. holds its temperature exactly after recovery. The DeKhotinsky varied approximately 2°, and the Freas as plotted by Mr. Cox—1½°. These temperatures on the various ovens are considered after return to 101°. In the A. O. C. S. oven, loaded one-half with treated seed and one-half with untreated seed, lower results were obtained when placing the treated seed on the upper shelves than when placed below. For temperature control and uniformity of results throughout the boxes, the A. O. C. S. oven is excellent; next comes the Freas Force-draft; and third, the DeKhotinsky. In temperature recovery the Freas first; DeKhotinsky second; A. O. C. S. third—this of course supposing that auxiliary adjustments are used to bring the temperature back.

It is recommended that the time of drying of untreated seed be increased to ten hours, and that the oven used be an A. O. C. S. or a Freas Force-draft, both being adjusted to a temperature of 101°—that the DeKhotinsky Oven now in the laboratories may be used for drying seed preparatory to treatment. For determination of moisture on meal and other work that may be in the laboratory where the oven used is likely to be opened during drying time of samples already in the oven, the Freas Force-draft is recommended because of its quicker recovery.

The Chairman desires to express his thanks to members of the Committee and to Messrs. Ainslie and Cox for their cooperation.

■

A slight increase in demand for American lard in Germany during the early part of July disappeared suddenly in the financial crisis, from which the business suffered throughout the remainder of the month. Dealers hesitated to lay in stocks of any kind and sellers did not urge them. Cash payments were demanded in most instances, credit being extended with reluctance. Prices for pure lard ranged between $19.75 and $21.50 per 100 kilos. Competing Danish lard sold at about $18.65 for box goods, per 100 kilos. Its importation, however, was greatly reduced by the difficulties arising from the financial crisis. Receipts of lard in Hamburg in July totaled 3,725,000 pounds, as compared to 7,452,000 pounds in June and to 9,436,980 pounds in July, 1930.

■

It is reported that Brazilian interests have imported 120 metric tons of soybeans from Dairen, Manchuria, for use as seed in initiating the culture of the beans in Brazil.

Cost Accounting a Field for Chemists

Advantages of Technical Training Renders Chemists and Chemical Engineers Well Fitted for Cost-Finding in Process Industries*

By W. J. REESE[1]

TO THOSE employing chemists, the number of applicants for the very limited number of openings is a constantly growing problem. The natural reaction is to give the applicant a chance to demonstrate his ability, or lack of it, but the limitations of laboratory budgets and laboratory space prevent—and the constantly increasing number of students along technical lines in our colleges and universities would indicate that there is no immediate danger of the demand exhausting the supply.

Another consideration which enters the problem is the nature of chemical work, particularly along industrial lines. Since such work is rather highly specialized, the tendency is to keep a man who has become fairly proficient, even if he is not all that might be desired, rather than to replace him with an inexperienced one without the assurance of bettering the situation. This tends toward long tenure and a very low turn-over, which is practically limited to emergency replacements and the filling of such new positions as the development of the industry may demand.

This question of employment has been the subject of considerable thought and discussion, both by educators and the chemical profession at large, and has brought out a great number of suggestions, both sound and visionary—the only really sound ones having to do with the broadening of the scope of chemical activities.

Speaking in commercial language, there are two means of expanding a limited market—first, to seek out an existing unfilled demand, second, to create a demand. Of these, the first method, if applicable, is, of course, the easier and more productive of results. In surveying the industrial field for possible unfilled demands for men with technical training along chemical lines, that portion devoted to "Cost Accounting" ("Plant Accounting-Cost Finding") appears to have been largely neglected and to give promise of responding to cultivation, particularly that portion of it having to do with the so-called "Process Industries."

Being primarily interested along chemical lines, the speaker is quite as competent to advise in the realm of accounting as the proverbial maiden aunt is to give advice regarding the rearing of a family. Realizing this limitation, the effort will be made to develop this discussion from the viewpoint of the chemist and leave any controversial points to be taken up from the viewpoint of the accountant, should any such be present.

It has been only within a comparatively short time that Cost Accounting has been recognized as a separate and distinct branch of the General Science of Accounting, with its individual problems and methods. Its rapid rise to prominence and its quick recognition as an essential member of the business machine, bear witness to the need which it is attempting to satisfy.

This urge for the accurate determination of costs is, of course, the outgrowth of the trend of modern business, with its smaller margins and greater diversification, and is common to all business enterprises. For the simpler ones, the standard forms of accounting have proven themselves to be quite adequate to give the desired information, but as the business becomes more complex, the problem becomes more involved and when it comes to the Process Industries—those industries taking in various raw materials and producing therefrom, by physical and chemical manipulation, finished products quite different in character, it has been found necessary to depart from the customary routine and attack the problem from a different angle and with different methods, since elements have been introduced quite foreign to standard accounting practice, which is built up on a basis of fixed values.

* Address before Annual Meeting, American Oil Chemists' Society, New Orleans, May, 1931.

[1] *Chief Chemist, Colgate-Palmolive-Peet Co., Kansas City.*

Cost accounting, like most technical activities, divides itself into two distinct parts—the field work and office work. The first has to do with the obtaining and collecting of the data, the second records, tabulates, calculates and interprets them.

The relationship between the control laboratory of a process industry and the cost accounting or plant accounting department is a very close one, since the greater proportion of the chemical work done is either directly or indirectly for the cost accounts. In fact, it would be perfectly correct to say that the control laboratory is a very important branch of the cost accounting department, although not usually so considered, and the whole system of cost accounting resolves itself, on a critical analysis, into a chemical engineering problem, in that its function is to evaluate the results of manufacturing operations in terms of cost. If this postulate is conceded, and it would appear to be axiomatic in the case of the process industries, which are the ones under discussion, it would be only logical that the cost accounting system for such an industry should be designed by a chemical engineer and operated under his direction by a staff with chemical training and experience. It is equally logical to demand that this system follow sound accounting practice, and arrive at results in an orderly manner which lends itself to formal records and may be easily and intelligently reviewed. This requires a thorough knowledge of the theory and practice of accounts. In other words, all that is required for such a job is a composite "Chemist-Accountant."

It is very easy to state the demands as above —quite another to fill these demands. There are certain fundamental incompatibilities in the mental attitude of the chemist and accountant which must first be brought into harmony, or sufficiently modified for the purpose at hand. The chemist, by choice, training and necessity is essentially pragmatic in his outlook — the accountant is essentially dogmatic. The conception of relativity is very easy for a chemist, since it is but a formal statement of his credo. All the ultimate realities of his universe have been recognized from the beginning of his training as being only relatively fixed, the degree of precision varying with the demands of the particular problem. Such a conception is beyond the power of imagination of the typical accountant. To a chemist, a figure represents a value plus or minus the probable error in its derivation—to an accountant, a figure is just that—absolute—regardless of the probabilities. This is not leading up to a dilemma. On the contrary, both these mental attitudes are desirable for the satisfactory solution of the problem proposed.

Practically the same problem has confronted other branches of the engineering profession, which they have solved quite satisfactorily. For example, a construction company is asked to furnish plans and make an estimate on the construction of a bridge. The ordinary procedure would be for the field crew to make the necessary surveys to determine the height, length, character and location of footings, etc., determining the data as closely as the character of the job dictates—the degree of precision being entirely different for a wagon bridge over Deer Creek and a cantilever bridge over a navigable stream—but, regardless of the degree of accuracy in obtaining the data, the office calculations are carried through with the same degree of precision—both phases of the work being carried on under the same engineering direction. It would be considered absurd to turn the collected data over to accountants with no engineering training or experience for calculation.

As stated previously, cost accounting divides itself into two phases—what might be called field work and office or clerical work, and both phases, in order to function properly, should be under the supervision of a chemical engineer, or at least someone with considerable technical training and experience. While accounting methods and procedure must be used in the handling of the clerical phase, it would be much simpler and easier for a chemist to master the intricacies of modern accounting practice than for an accountant to acquire technical chemical training.

This is a broad statement which will require some qualifications. It is not intended to imply that any chemist or student of chemistry is a potential cost accountant any more than he is a potential educator, industrial chemist or research man — but, for the man with the appropriate mental bent, the field lies open.

In choosing a career, several things must be taken into consideration besides one's mental bent and aptitudes. Probably the first question should be — what is the importance of the work and does its accomplishments justify the effort? — and, the next should be — what are the opportunities for personal growth and advancement?

One may be kept very busy carrying brick from one side of the yard to another—then carrying them back again—but there is nothing in such employment to stir the imagination or

(*Turn to Page 357*)

Review and Coordination of Committee Recommendations

Uniform Methods and Planning Committee of American Oil Chemists' Society Reports on Methods Revisions

By JOHN J. VOLLERTSEN, *Chairman*

AS CHAIRMAN of the Uniform Methods and Planning Committee we wish to take this opportunity of expressing our appreciation to the various members of this committee for the cooperation which we have had from them. We feel that during the past year committees have been handled in a much more efficient manner than heretofore and are hoping that a similar improvement will be shown by the next committee.

Kreis Test Committee

THE Kreis Test Committee has done considerable cooperative work but has not been able to obtain consistent check results. Their recommendation is that the Kreis Test be not incorporated as a method of the society and this recommendation is approved by the Uniform Methods and Planning Committee.

Referee Board

THE Referee Board recommends the continuance of the check work on the refining of crude oils and the reading of colors, and state that this work should be enlarged. We approve this recommendation and suggest that if possible this check work be extended to other than refinery laboratories, in a manner similar to that used by the Smalley Foundation Committee.

Sampling Committee

LAST year the Serbell sampling tube was recommended as a tentative sampler and it was suggested that they be obtained to determine its efficiency in actual commercial use. This was done and the committee recommends the adoption of this sampling tube as official. This recommendation has our approval.

The Committee on Crude Mill Operations made no report or recommendations.

Committee on Petroleum Ether

DURING the recent crushing season a committee was appointed to investigate the use of solvents for fat extraction. The new specifications which they recommend are as follows:

"The solvent used should be of the pentane type, containing a minimum amount of iso-pentane, iso-hexane, and hexane. The following specifications would give a product meeting the above requirements:

Initial boiling temperature	—not less than 35° C.
" " "	—not over 40° C.
Dry flask end point	—not over 60° C.
" " " "	—not less than 50° C.
At least 95% distilling under	—55° C.
Not over 85% distilling under	—40° C.
Specific gravity at 60° F.	—.630 to .675
Color—water white	
Evaporation residue	—not over .002% by weight
Doctor test—sweet	
Copper strip corrosion test	—non-corrosive
Unsaturated compounds	—trace only permitted

This product would have approximately the following composition:

Iso-pentane	0% to 5%	or about	2%
Normal pentane	70% " 85%	" "	80%
Iso-hexane	5% " 20%	" "	9%
Normal hexane	5% " 20%	" "	9%

The Uniform Methods and Planning Committee approve this recommendation for tentative adoption.

Soap Committee

THE Soap Committee made the following recommendations, all of which are approved by the Uniform Methods and Planning Committee.

1. That the Detergents Committee continue as at present organized until after its report at our next fall meeting.
2. That the Soap Analysis Committee continue its cooperative work on developing a method for determining unsaponifiable matter in filled soaps containing rosin, lanolin, etc., and be requested to review and revise the Standard Methods of Sampling and Analysis of Soap and Soap Products as adopted by the American Chemical Society and the American Oil Chemists Society.
3. That the Glycerine Analysis Committee continue its cooperative work on the cause

of the discrepancy between the analysis of glycerine by the specific gravity and bichromate method on one hand and the acetin method on the other as proven by the committee work this year.

The Committee on the Analysis of Commercial Fats and Oils advise that they have no report for the present meeting.

Refining Committee

THE following recommendations from the Refining Committee have our approval.

"First, add to the note at the end of Rule 273, section 5 (d) on Refining Procedure, the following paragraph:

'The filter paper used must be a white paper of good quality so that the filtered oil will have a color substantially equivalent to that filtered thru Whatman's No. 40 paper.'

"Second, in the same section (d) on Refining Procedure, insert the following, beginning in the seventh line from the bottom, replacing the clause beginning with the woods 'cool and decant.' The new clause will read as follows:

'Cool in the cold water bath for 15 minutes or until thoroly chilled. Then decant into a weighed beaker any additional oil thus recovered, and drain for 15 minutes.'

"Third, in the same section (d) on Refining Procedure, in the ninth line, change the parentheses to read as follows:

'45 minutes for oils designated as expeller or slow breaking type oil.'"

(NOTE: The reason the Rule Numbers are used herein is to save space in recopying entire sections of the methods.)

Color Committee

THE Color Committee made the following recommendations:

"1. Feeling the urgent need of a standard tintometer and considering the many requests for such, the Committee recommends that the Society adopt as a tentative Standard the enclosed Wesson Type Instrument illustrated by the attached drawings.

NOTE: The drawings* describe an instrument of practically the same dimensions as the Wesson type manufactured by the Emil Greiner Company, which is now in use in most laboratories. They recommend that the old type eye piece be adopted and vote against the split field type."

The Uniform Methods and Planning Committee approve this recommendation but with the understanding that the blue print will be modified to permit the use of the split field eye piece.

"2. That the Standard Set of Lovibond Color Glasses be adopted; the glasses to compose the set are shown in the proposed Rule which is attached."

We approve this recommendation.

"3. We recommend that the Society have a supply of the Standard Color tubes manufactured and furnish them to the members at cost."

We approve this recommendation.

The Committee on the Analysis of Cottonseed made a report, but it contained no recommendation.

It is the recommendation of the Uniform Methods and Planning Committee that a committee be appointed to study the determination of free fatty acids in seed.

The Moisture Committee spent its time in working on the determination of moisture in seed. They recommend that the Freas Forced Draft Oven be permitted as a moisture oven.

We approve this for tentative adoption and recommend that further work be done on the use of higher temperatures and shorter time in determining moisture in seed.

The personnel of the Uniform Methods and Planning Committee for 1930-31 was as follows: J. J. Vollertsen, *Chairman*, A. Campbell, N. C. Hamner, C. B. Cluff, E. T. Marceau.

■

The Sixth Annual Convention of the Mayonnaise Manufacturers Association will be held in Chicago, October 26, 27, 28, 1931, at the Hotel Stevens. The tentative program includes several open sessions, closed sessions for active members, conferences of associate members, meetings of the Board of Directors and the annual banquet.

■

A report from Consul Garrety at Tahiti, Society Islands, states that exports of copra to the United States during the 2nd quarter of 1931, totalled 59,012,733 pounds valued at $1,263,450 as compared with exports of the corresponding quarter of 1930 of 14,024,984 pounds and $210,291.

■

A cable from Commercial Attache Arnold at Shanghai, China, dated August 13, states that the flooded condition of the Central Yangtze valley is expected to seriously affect the supply of several varieties of oil seeds that enter into China's export trade. This is particularly true of the sesame seed crop which was badly damaged and forward purchases are now impossible although existing stocks are believed to be sufficient to supply orders already booked.

* *See O. & F. I., Vol. 8, pp. 303, August, 1931.*

Spanish Olive Oil

During the first three months of 1930 and 1931, olive oil exports from Spain amounted to 19,722,178 and 20,035,335 kilograms respectively; for March, 1930, and 1931 exports amounted to 8,313,441 and 7,992,738 kilograms. The three principal countries of destination were Argentina, Italy and the United States, the Argentine leading with a total of 3,723,458 for the first three months of 1930 and 5,662,592 kilograms for the first three months of 1931; for March, 1930, exports amounted to 1,461,636 and for March 1931, 2,233,046 kilograms. Exports to Italy during the first three months of 1930 and 1931 were 2,989,818 kilograms and 3,315,878 respectively; for March, 1930, exports were 2,069,872 and for March, 1931, 1,327,299. Exports to the U. S. for the first three months of 1930 and 1931 were 2,651,306 and 2,878,081, respectively; for March, 1930, and March, 1931, exports were 934,941 and 1,132,437, respectively. This information was forwarded to the Department of Commerce by Assistant Commercial Attaché Julian C. Greenup at Madrid, Spain.

■

The Transit Milling Company has been organized by Geo. H. Gymer of Galveston, Tex., with offices in that city and in Sherman, Tex., to lease and operate the cottonseed cake grinding plants at Sherman and at Cairo, Ill., formerly operated by R. L. Heflin, Inc. The Graco Milling Co., at Sherman, also a Heflin interest is included in the deal. Mr. Gymer has been the general manager of the Heflin business for some years. The new company will do a domestic business in cake of various special sizes and in cottonseed meal, as well as an export business from Gulf ports.

■

The annual golf tournament of the Oil Trades Association of New York was held at Pelham Country Club, Pelham Manor, N. Y., September 1. According to an announcement by Jos. C. Smith, secretary of the association, the date for the fall banquet, which will be held at the new Waldorf-Astoria Hotel, is October 5.

■

Exports of caustic soda from the United States amounted to 12,142,174 lbs. during May, 1931, the value being $325,825. The largest buyer was Japan with purchases aggregating almost four million pounds.

■

The Quanah (Tex.) Cotton Oil Company is building a new postless all-steel seed house, 60x190 feet and 50 feet high, to replace the one burned recently.

American Chemical Society

PAPERS of particular application to the chemistry and technology of oils and fats which were presented at the meeting of the American Chemical Society at Buffalo during the week of August 31 included the following, given here in abstract:

Thiocyanogen Number and Its Application to Studies of Lard. Lawrence Zeleny and C. H. Bailey. It was found necessary to slightly modify Kaufmann's technique for determining the thiocyanogen number in order to apply it satisfactorily to the study of lards. The difference between the iodine number and thiocyanogen number of a lard is a measure of the linolic acid content of the lard, assuming that there are present no acids of a higher degree of unsaturation than linolic acid (which is probably not strictly true). From these two constants, then, may be calculated the percentages of oleic acid, linolic acid, total unsaturated acids, and total saturated acids. Applying this method to the study of partially hydrogenated and partially oxidized lards, it was found that the linolic acid in lard, or at least one of the double bonds of linolic acid, is much more reactive to both reduction and oxidation than is the double bond of oleic acid. Since the linolic acid (and without doubt, traces of more highly unsaturated acids) may be almost completely reduced by a very small amount of hydrogenation, and since oxidation attacks the linolic acid first, it should be possible to appreciably increase the stability of a lard by such a small degree of hydrogenation that the physical properties would not be appreciably altered.

A Method for the Estimation of the Gossypol Remaining In Cotton Seed Meal. J. O. Halverson and Frank H. Smith. The Withers-Carruth method for the estimation of gossypol in cotton seed as modified by Schwartze is not adequate for meal. The modified method consists of the following steps: The removal of a part of the oil in the meal by a preliminary extraction with petroleum ether. After thorough extraction of gossypol from the airdry meal with U. S. P. ethyl ether and removal of the ether under partial vacuum, the residue is diluted with petroleum ether and constantly agitated over night, the ether insoluble material is then filtered off. Ethylene glycol aids precipitation of the dianiline gossypol on the steam bath in the presence of a high B. Pt. petroleum ether. After shaking over night, precipitates of a high degree of purity are completely obtained. Certain cotton seed meals by this method gave somewhat more gossypol. Limited data show a variation of 0.0065 to .0519 per cent.

Synthetic Glycerides of Fatty Acids. D. T. Jackson, H. E. Robinson and C. G. King. The mixed glycerides (distearins) of stearic acid with the C_4, C_6, C_8, C_{10}, C_{12}, and C_{16} acids have been prepared and further evidence obtained regarding their structures by the use of different intermediates. Mono- and di-trityl ethers of glycerol have been used for the preparation of mono- and diglycerides of fatty acids for the first time, and these ethers have also given evidence of a shift in molecular structure similar to that furnished by previous work.

Some Characteristics of Colors in Vegetable Oils, and Methods of Removing Same. B. H. Thurman. Vegetable oils can be classified as to their origin by their color. For instance, nut oils approach being colorless; oils from seeds and from the pericarps surrounding the nuts of plants, are always distinctly colored. This coloration may vary in the individual oil according to its method of preparation from the seed or the nut. Some discussion is given to the identity of the color in vegetable oils, its effect in commercial use and commercial methods of removing it. In the removal of color from vegetable oils, certain effects of chemical reactions are described as well as the effect of different decolorizing agents which remove color by reducing or oxidizing it, and the removal of color by adsorption.

■

The constitutionality of the Federal tax on margarine has been questioned by the Ed S. Vail Butterine Company, which has filed a petition for a review by the United States Supreme Court of a decision of the Circuit Court of Appeals for the Seventh Circuit, which held that the margarine tax had been properly levied against the company. The petition to the Supreme Court asserted that the classification made by the tax law is based on wheher the color of a food product is natural or artificial. This classification is termed by the petitioner as arbitrary, unreasonable and constitutes class legislation. It is further asserted that the tax is a penalty or punishment and that the law, under the guise of a revenue law, is a regulation of an industry entirely under state control.

■

The final Egyptian Government estimate of the 1930-31 cotton crop is placed at 793,524,600 pounds as compared with 824,615,946 pounds the final Government estimate for the 1929-30 season.

Fat and Oil Data for Second Quarter 1931

Production, Consumption, Exports and Imports with Factory and Warehouse Stocks, June 30, 1931

WASHINGTON, D. C., August 7, 1931.—The Department of Commerce announces according to Census returns the factory production of fats and oils (exclusive of refined oils and derivatives) during the three-month period ended June 30, 1931, was as follows: vegetable oils, 389,914,804 pounds; fish oils, 4,646,527 pounds; animal fats, 559,578,840 pounds; and greases, 94,984,724 pounds; a total of 1,049,133,895 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 408,080,825 pounds appears for lard. Next in order is tallow with 150,480,410 pounds; linseed oil with 130,634,669 pounds; cottonseed oil with 95,214,824 pounds; coconut oil with 81,899,181 pounds, and corn oil with 28,978,208 pounds.

The production of refined oils during the period was as follows: Cottonseed, 144,719,835 pounds; coconut, 67,350,610 pounds; peanut, 2,571,910 pounds; corn, 25,862,345 pounds; soya-bean, 7,816,453 pounds; and palm-kernel, 6,742,679 pounds. The quantity of crude oil used in the production of each of those refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statement:

PRODUCTION, CONSUMPTION AND STOCKS OF FATS AND OILS

(In some cases, where products were made by a continuous process, the intermediate products were not reported.)

KIND	Factory operations for the quarter ended June 30, 1931		Factory and Ware'se stocks, June 30, 1931
	Production (pounds)	Consumption (pounds)	(pounds)
VEGETABLE OILS: [1]			
Cottonseed, crude	95,214,824	163,817,858	13,918,562
Cottonseed, refined	144,719,835	242,191,311	348,438,087
Peanut, virgin and crude	4,061,230	2,943,514	6,247,091
Peanut, refined	2,571,910	3,543,864	4,347,455
Coconut, or copra, crude	81,899,181	139,128,413	206,123,491
Coconut, or copra, refined	67,350,610	78,348,197	16,038,872
Corn, crude	28,978,208	30,355,459	7,658,355
Corn, refined	25,862,345	3,633,722	12,085,154
Soya-bean, crude	10,996,129	11,428,008	14,989,462
Soya-bean, refined	7,816,653	5,494,637	3,348,507
Olive, edible	—	488,871	5,507,231
Olive, inedible	—	2,011,810	1,896,675
Sulphur oil or olive foots	—	10,675,647	12,126,147
Palm-kernel, crude	5,243,433	16,320,201	11,754,442
Palm-kernel, refined	6,742,679	6,191,201	1,917,503
Rapeseed	—	2,161,485	5,417,344
Linseed	130,634,669	95,544,345	78,199,811
Chinese wood or tung	—	24,519,502	34,192,721
Chinese vegetable tallow	—	622,744	2,107,125
Castor	13,732,116	4,612,431	8,105,869
Palm	—	63,017,635	80,427,960
Sesame	18,951,034	9,330,570	13,356,281
Sunflower seed	—	9,087,801	13,571,871
All other	203,980	2,109,187	2,308,277
FISH OILS: [1]			
Cod and cod-liver	31,571	3,823,948	8,727,770
Menhaden	862,391	4,811,072	3,627,632
Whale	330	19,614,422	152,101,843
Herring, including sardine	3,536,280	25,302,652	84,613,105
Sperm	—	319,591	4,758,708
All other, (including marine animal)	215,955	593,810	8,276,767

[1] The data of oils produced, consumed, and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries.

PRODUCTION, CONSUMPTION, AND STOCKS OF FATS AND OILS

KIND	Factory operations for the quarter ended June 30, 1931 Production (pounds)	Consumption (pounds)	Factory and Ware'se stocks June 30, 1931 (pounds)
ANIMAL FATS:			
Lard, neutral	5,105,257	1,884,176	3,663,502
Lard, other edible	402,975,568	3,258,398	100,731,981
Tallow, edible	16,595,441	19,230,489	5,902,305
Tallow, inedible	133,884,969	140,606,075	165,240,809
Neat's-foot oil	1,026,605	1,090,207	1,444,297
GREASES:			
White	16,170,005	10,057,424	12,652,372
Yellow	20,658,402	8,352,824	12,319,267
Brown	13,194,087	14,112,448	15,302,182
Bone	7,694,130	91,774	4,225,136
Tankage	12,059,219	138,118	5,532,735
Garbage or house	19,103,569	19,792,868	19,689,315
Wool	2,683,077	1,091,957	4,825,122
Recovered	749,280	369,496	4,737,402
All other	2,672,955	1,708,225	3,790,408
OTHER PRODUCTS:			
Lard compounds and other lard substitutes	278,215,970	188,835	25,140,388
Hydrogenated oils	155,030,585	140,119,588	22,139,145
Stearin, vegetable	4,567,389	3,869,488	2,348,651
Stearin, animal, edible	12,781,081	9,391,917	3,199,002
Stearin, animal, inedible	3,214,256	4,342,636	8,150,050
Oleo oil	28,568,672	7,932,502	12,132,460
Lard oil	5,553,347	2,885,942	4,935,067
Tallow oil	1,975,044	2,923,602	2,531,448
Fatty acids	34,052,589	36,618,842	9,193,834
Fatty acids, distilled	16,396,561	15,779,773	3,704,359
Red oil	8,255,104	5,946,760	6,887,590
Stearic acid	6,656,355	2,059,010	4,280,901
Glycerin, crude 80% basis	35,178,569	37,303,049	13,183,235
Glycerin, dynamite	10,748,234	4,567,768	11,685,623
Glycerin, chemically pure	19,132,510	2,501,647	10,778,964
Cottonseed foots, 50% basis	25,552,919	39,787,210	76,065,904
Cottonseed foots, distilled	19,602,625	20,251,045	7,431,196
Other vegetable oil foots	15,155,193	11,710,295	5,340,417
Other vegetable oil foots, distilled	1,115,586	926,160	1,538,488
Acidulated soap stock	10,459,426	12,102,802	20,866,655
Miscellaneous soap stock	510,176	485,612	837,038

RAW MATERIALS USED IN THE MANUFACTURE OF VEGETABLE OILS

KIND	Tons of 2,000 pounds Consumed Mar. 31 to June 30	On hand June 30	KIND	Tons of 2,000 pounds Consumed Mar. 31 to June 30	On hand June 30
Cottonseed	286,551	33,327	Flaxseed	201,748	33,534
Peanuts, hulled	5,474	430	Castor Beans	15,244	2,547
Peanuts, in the hull	764	70	Mustard seed	579	1,540
Copra	63,434	17,491	Soya-beans	38,673	33,775
Coconuts and skins	630	53	Sesame	19,929	12,534
Corn germs	56,277	54	Other kinds	5,760	2,965

IMPORTS OF OIL SEEDS, QUARTER ENDED JUNE 30, 1931

KIND	Tons	KIND	Tons
Castor beans	13,211	Poppy seed	465
Copra	54,108	Perilla and sesame seed	26,613
Flaxseed	97,226	Other oil seeds	7,232
Palm kernels	5,113		

IMPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED JUNE 30, 1931

KIND	Pounds	KIND	Pounds
Animal oils & fats, edible	748,598	Coconut oil	73,832,195
Whale oil	86,573,040	Sulphur oil or olive foots	10,260,492
Cod oil	3,523,440	Other olive oil, inedible	3,985,579
Cod-liver oil	3,139,830	Palm-kernel oil	3,533,977
Other fish oils	3,973,785	Sesame oil	120
Tallow	121,641	Carnauba wax	2,528,990
Wool grease	1,358,749	Other vegetable wax	683,067
Stearic acid	1,604,324	Rape (colza) oil	3,556,088
Grease and oils, n.e.s (value)	$27,967	Linseed oil	124,586
Olive oil, edible	20,725,355	Soya-bean oil	781,527
Peanut oil	5,994,692	Perilla oil	6,351,639
Sunflower seed oil	25,801,963	Other expressed oils	1,128,291
Palm oil	63,760,557	Glycerin, crude	2,389,755
Other edible vegetable oils	2,789,619	Glycerin, refined	179,946
Tung oil	20,381,726		

EXPORTS OF FOREIGN FATS AND OILS, QUARTER ENDED JUNE 30, 1931

KIND	Pounds	KIND	Pounds
Animal fats & oils, edible	340	Coconut oil	220,160
Fish oils	111,363	Palm & palm-kernel oil	562,044
Other animal oils & fats inedible	32,825	Peanut oil	124,100
Olive oil, edible	28,189	Soya-bean oil	392,720
Tung oil	1,513,809	Other expressed oils & fats	137,020
		Vegetable wax	258,822

EXPORTS OF DOMESTIC FATS AND OILS, QUARTER ENDED JUNE 30, 1931

KIND	Pounds	KIND	Pounds
Oleo oil	12,067,954	Cottonseed oil, crude	1,977,960
Oleo stock	2,029,831	Cottonseed oil, refined	3,732,251
Tallow	726,265	Coconut oil, crude	3,555,869
Lard	122,177,703	Coconut oil, refined	1,006,345
Lard, neutral	2,314,541	Corn oil	232,922
Lard compounds, containing animal fats	499,385	Soya-bean oil	999,017
Oleo stearin	2,142,336	Vegetable oil lard compounds	1,191,657
Neat's-foot oil	240,090	Other edible vegetable oils and fats	586,953
Other animal oils, inedible	467,154	Linseed oil	345,062
Fish oils	337,378	Other expressed oils and fats, inedible	375,409
Grease stearin	799,082	Vegetable soap stock	7,447,344
Oleic acid, or red oil	211,912	Glycerin	85,216
Stearic acid	114,628		
Other animal greases & fats	18,445,405		

Marseilles Oil Industry

Vegetable oil production volume suffered relatively little during the past year despite prevailing unfavorable business conditions, according to Consul Calvert at Marseilles, writing under recent date. However, in point of value, because of lower prices realized, financial returns on production were much reduced. The crushers and refiners of vegetable oils in the Marseilles district experienced a steady drop in selling prices of their products last year, which continued up to the end of May of the present year, but inasmuch as raw material costs also dropped, losses were partially compensated.

The importation of oilseeds during the first five months of the current year exceeded imports for the corresponding period of last year by nearly 50,000 metric tons, chiefly attributable to an active demand for shelled peanuts and heavier arrivals of copra. Vegetable oil mills reported their failure to realize better prices last year as due to the excess supplies of whale oil which particularly affected the price level for coconut oil.

For centuries, Marseilles has been recognized as a soap manufacturing center. This industry maintained its volume of output at satisfactory prices in the face of reduced operations in other industries. Prices of raw materials having declined in greater proportion during 1930, soapers were obliged to reduce prices on their products.

■

Production of olive oil in Algeria during the 1930-31 season was much below the average, amounting to approximately 3,328,542 gallons or about half of the 1929-30 production of 6,089,445 gallons. The outlook for the coming season 1931-1932 is very favorable and providing present conditions continue, a good crop may be expected.

■

"Mother," said the small boy, "do they have oil refineries in heaven?"

"No, dear," replied mother, "it requires engineers to build oil refineries."

Notes of the Industry

German Lard Imports

Germany has offered in recent years a market for large quantities of lard, the greater part of which has been imported from the United States. Denmark, however, has been steadily increasing its lard exports to this country, and its competition is now keenly felt by American lard exporters. The largest importation of lard in recent years was in 1926, when 109,000 metric tons were brought into Germany valued at $39,000,000. The importation since then has fallen off and in 1930 reached a total of 80,000 tons valued at about $21,700,000.

In 1926, the United States supplied 87 per cent of the total amount of lard imported into Germany. The only other country of importance as a source of supply was Denmark which supplied 7 per cent. Since then, the proportion of lard imported from the United States has grown smaller while the part supplied by Denmark has steadily increased until in 1930, the importation from the United States had fallen to 79 per cent while that from Denmark had increased to nearly 19 per cent of the total. During the first five months of 1931, the importation of lard from the United States suffered a further reduction to 75 per cent of the total, while shipments from Denmark amounted to 20 per cent.

■

The law passed by the Colorado legislature and signed by the governor in May last, levying a tax of 15 cents a pound on margarine and shortening containing less than 45 per cent of animal fats, has been declared inoperative by the Secretary of State as result of the filing of a petition for a referendum on the tax. The petition had 21,487 signatures and provides for submission of the question to the voters at the next general election. If that course should fail to defeat the measure it will probably be fought on its constitutionality as confiscatory and class legislation.

■

A report from Trade Commissioner Hendren at Batavia, Dutch East Indies, states that the estimated production of palm oil for 1931 is placed at 38,902,400 kilos. The production for January amounted to 2,768,149 kilos. The Government placed 19 estates on the reporting list. The production of palm kernels for 1931 is put at 7,739,450 kilos. Production for January totalled 607,115 kilos.

Trade Commissioner Carlson, at Oslo, Norway, advises under recent date that a new law has been passed by the Norwegian Parliament authorizing butter as an ingredient for margarine, the exact quantities to be determined subsequently either by Royal Decree or the proper government department having jurisdiction over such matters. In the meantime, the Norwegian government is inviting suggestions from margarine churners in that country and no action will be taken until each manufacturer has had an opportunity of submitting his recommendations, inasmuch as there exists a belief that the government should make provision for varying proportions of butter to enable margarine to compete according to available supplies of the latter. An effort made to promulgate regulations making it mandatory that restaurants and other places of sale post notices to the effect that margarine was served or sold on the premises, failed of approval.

■

Spanish Exports of Olive Oil

The following table shows Spanish exports of olive oil during the first four months of 1931 and 1930:

	First Four Months	
	1931	1930
	Kilos	Kilos
Argentina	6,690,587	5,760,191
Cuba	2,238,004	3,354,958
Italy	5,483,264	3,971,721
United States	4,051,792	3,672,990
Other countries	8,041,873	10,941,463
Totals	26,505,520	27,701,323

■

In a report from Consul Langdon at Dairen, it is stated that the total carryover of stocks of Manchurian soybeans for last season (1930) is estimated as between one million and one and one-quarter million tons, about half of the tonnage in South Manchuria. In local trade circles, the carryover of the present season's crop is expected to be very small because of greatly increased domestic consumption owing to the higher cost of imported feedstuffs due to depreciated silver currency.

■

R. L. Stigler, formerly manager of the Buckeye Cotton Oil Co.'s plant at Little Rock, Ark., and recently in the brokerage business in that city has been elected assistant to General Manager P. F. Cleaver of the Rose City Cotton Oil Co. of Little Rock, succeeding W. H. Loflin, resigned.

Hankow Sesame Seed

The Hankow sesame seed market during the month of June was not as active as during May. There was a decline in price and a decrease in exports. Seeds of the yellow variety constitute the only type of sesame seed which enter in appreciable quantities into the export trade of this district. June exports of sesame seed to the United States and Europe from Hankow showed a 69.8 per cent decrease as compared with May due to movement of troops and supplies over the railways. Only small cargoes of seeds are being loaded on ocean carriers that are at present frequenting the port during the high water shipping season.

Exports of seed from Hankow during June amounted to 2,341 short tons, of which 1,803 tons went to the United States and 538 to Europe. Total shipments to the United States for the first six months were 23,824 short tons and shipments to Europe totaled 2,847 tons. From the most reliable information obtainable, it is reported thaat approximately 400 short tons of seed were stored in Hankow at the end of June. Stocks at Chiaokow, a suburb of Hankow, were reported to be 800 tons. Stocks at concentration points along the Peiping-Hankow railway were reported to be on June 30 approximately 20,000 short tons.

■

Recently the Government of Latvia submitted a new plan to Parliament to increase import duty on various commodities including lard, which has been one of the principal articles imported from the United States. The Government project provides for an increase in duty on lard from 0.10 Lats per kilo to 0.60 Lats per kilo net ($0.019 to $0.114.) (Report from Commercial Attache Morse at Riga.)

■

A report descriptive of the Egyptian cotton and cottonseed products industries, their progress in recent years, and their importance from the standpoint of furnishing a source of supply for the consuming markets of Europe has been prepared by Assistant Trade Commissioner Ferrante of the Cairo office for the benefit of the oils and fats industries of the United States. The report embraces considerable interesting statistical data. Copies of this report can be secured on request, from the Bureau of Foreign and Domestic Commerce, Foodstuffs Division, Washington.

■

George S. Harris has been appointed manager of the Ashdown (Ark.) Mill of the Temple Cotton Oil Co., succeeding Frank E. Howson, resigned.

Manchurian Soybeans

The tone of the European market in June showed some improvement, although the volume of business was not large. Prices were weak in the first half, declining from $26.55 per short ton to $26.00 on the 16th of the month. However, the war debt moratorium had an effect on the market and prices advanced to $28.47. Prices closed on the 30th at $27.92 per short ton.

The Dairen market was quiet and uneventful and followed the trend of Europe. Japanese and Dutch East Indies demand was steady and constant for nearby shipment. Rather large up-country stocks were liquidated by the provincial government banks during the course of the month.

The turnover in the Dairen Exchange in the month of June totaled 252,714 tons, or 36,729 tons less than the turnover in the corresponding month of 1930. Deliveries amounted to 19,206 tons, consisting largely of provincial government stocks. June 1931 stocks at Dairen wharves totaled 114,932 tons as compared with 56,697 tons on hand in June, 1930.

American demand for soybean cake and meal continued dull, and total exports declined to 900 tons, as compared with 2,530 tons in the preceding month. The European demand for oil was weak during June, the market being depressed by low quotations on competing vegetable oils. The Dairen market was also colorless and uneventful.

■

It is estimated that the yield of oil from the present Spanish olive crop will amount to 180,000 tons, and that there are stocks on hand amounting to 300,000 tons making a total of 480,000 tons available for consumption and export. The quality of the oil is said to be poor, having a high acidity. The current demand for Spanish olive oil appears to be only fair. Demand in Spain is diminishing on account of the falling off of its use in cooking. Italy which is a large consumer of Spanish olive oil, is said to be making many of its putchases in Tunis, Algeria, Greece, and Turkey, where prices are lower.

■

Although the United States still maintained a lead in exports of lard to Czechoslovakia, imports from that country declined from 1,318 tons in April, 1930, to 623 tons in April, 1931. On the other hand, imports of lard from Holland increased from about 200 tons in April, 1930, to 596 tons in April, 1931. (Report from Assistant Trade Commissioner Woods at Prague.)

Tunisian Olive Oil Market

With a somewhat overstocked Mediterranean market the present situation in Tunis is calm. After the low yield of 20,000 metric tons registered in 1930 for Tunisian olive oil, expectations for the coming season foreshadow a but average crop of olives. Local market quotations reached $23.52 to $23.91 per 100 kilos for the first grade oil and $19.99 to $20.18 for the "masri" quality. Prices quoted at Sousse during the quarter were $22.74 for the first grade and $19.60 for "masri". These quotations are nearly identical with those of the March quarter, 1931. (*Report from Consul at Tunis, Tunisia.*)

■

Harry J. Mantia, a director of Leghorn Trading Co., New York, recently returned from a trip to Europe where he conferred with a number of the principals represented in the United States by his concern. The Leghorn Trading Co. specializes in olive oil and olive oil foots and also sells the "Spinelli" brand of Messina essential oils produced by Citrus Oils Co. On his return Mr. Mantia expressed himself as being optimistic on the business outlook both here and abroad.

■

J. Wrench, Sales Manager, Industrial Chemical Sales Company, New York, left on August 14th on an extended tour of the country as far as the Pacific Coast for the purpose of visiting the sales offices of the company in connection with the sale of their Nuchar activated carbon. After visiting the coast offices, Mr. Wrench plans to stop in Denver and Chicago enroute home to New York, where he is expected to arrive during the second week of this month.

■

The Tri-State Oil Mill Superintendents Association held the first of three regional meetings following a dinner at the Claridge Hotel, Memphis, recently. A. P. Holly, superintendent of the Perkins Oil Mill, Memphis, read an interesting paper on "The Merchandising of Cottonseed Products." It was decided that the second regional meeting should be held at Little Rock, Arkansas, and the third at Greenwood, Miss. There were 35 members present at the first dinner and meeting.

■

At the meeting of the directors of Procter & Gamble Co. held in Cincinnati the following were elected as vice-presidents of the company: Stockton Busby, R. K. Brodie and F. M. Barnes.

The United States Supreme Court has been petitioned to review decisions of the Circuit Court of Appeals for the Fifth Circuit in cases involving a question as to whether or not the product of the Standard Margarine Company of Florida is taxable as margarine. The Commissioner of Internal Revenue decided that it was artificially colored margarine and assessed a tax of $5,000 on 50,000 pounds estimated to have been produced in January, 1929. The company declared the product was not margarine and obtained a preliminary injunction in the Federal district court for the southern district of Florida. Upon appeal to the Circuit Court of Appeals the decision of the lower court was affirmed. The government, in asking for a review, asserted that the question involved is of importance to the government in the administration of the revenue law.

■

The South Texas Cotton Oil Company reported a net income of $171,947 for the fiscal year ended April 30, 1931, equivalent, after preferred dividends, to $1.58 per common share, compared to $237,438, or $2.21 per common share, in the preceding fiscal year. As of August 1, 1930, the company disposed of its stock holdings in the Magnolia Gas Products Company to the Air Reduction Company, New York, and distributed the stock of the latter company received to its own stockholders. Current assets as of April 30 totaled $1,776,544 and current liabilities were $531,485. Total assets were $4,800,060.

■

Robert Hebert, who is now associated with T. G. Cooper & Co., Philadelphia, arrived in New York, August 8th, on the *Staatendam*, after a five weeks business trip to London, Liverpool and the Continent. He sailed for Liverpool, July 3rd, on the *Britannic*.

■

A cable from Trade Commissioner Squire at Sydney, gives exports of unrefined tallow from Australia during June, 1931 as 5,772,144 pounds.

■

J. V. Madden, formerly superintendent of the Corinth (Miss.) Oil Mill has been appointed superintendent of the Osceola (Ark.) Cotton Oil Co.

■

Referee Applicant: A. G. Hayes, of Memphis, Tennessee, has applied for Referee Certification for all products covered by the rules of the National Cottonseed Products Association, (Second publication).

Cost Accounting

(*From page* 344)

give the feeling of accomplishment. Satisfactory employment must do both. The field of cost accounting should be broad enough to satisfy the demands of the most ambitious, since its function is to analyze all the elements of cost entering into a business, distribute them equitably to all its different departments and activities and finally equate them against the product. If properly carried out, the cost accounts become the chart, compass and sextant of modern business, the determining factor in fixing its course and policy. To use another figure, the cost accounts should be the fluoroscope which lays bare all the intimate inner workings of a business, and the cost accountant is in the position of the observing physician —ready to note and act upon any pathological signs which may appear.

With this intimate knowledge of the complete details of a business, it is hardly necessary to enlarge upon the opportunities for service offered.

Few chemists enter the commercial field with chemical work as the ultimate objective. Most have their ambitions directed toward executive positions and regard the laboratory as a good mounting block. In most manufacturing businesses there are three main avenues of advancement open—sales, office and operation. Most workers have but one choice, but for the technically trained cost accountant two avenues are always open, and the distance he can go along either or both is limited only by his capabilities and his willingness to accept responsibility.

With cost accounting, so to speak, just at the transition from an art to a science, it would seem to be an opportune time to urge that the chemical profession recognize cost accounting for the process industries as coming within the scope of its activities, and that educators take what steps are necessary to offer special preparation for this line of chemical work. This is done not from a selfish point of view as preempting a line of employment for chemists, but with a firm conviction that a properly trained chemist is the logical candidate for such a position, and that his employment in this capacity will be for the best interests of all concerned.

■

The acreage devoted to coconuts in the Philippines during 1930 was 1,359,297 acres reports Trade Commissioner Rohrer at Manila. This compares with 1,312,200 acres devoted to the crop in the previous year, 1929.

Governing Committee

(*From page* 336)

Meeting, May 14 and 15, 1931, was authorized to draw on the finances of the Society to the sum of $150.00, to defray expenses of Meeting, Banquet and Entertainments of the Meeting; if the fees collected at Registration Desk were not sufficient. There being no further business, the meeting was adjourned.

J. C. P. HELM, *Secy.* W. H. IRWIN, *Chairman.*

■

Marseilles Olive Oil Market

Conditions in the Marseilles olive oil market were fairly satisfactory during the June quarter. Prices were lower than at the time of the last crushing season, but this is due mainly to the fall in the value of the peseta, as the huge Spanish production necessarily has an effect on all markets. However, prices which were regularly declining up until the end of May showed an upward tendency in June, and the present situation is favorable. The small yield of the past season is expected to remedy the condition caused by the abundant world production of 1929-30, and to clear stocks which were being held. The lower prices have apparently created a new demand for olive oil replacing to a certain extent that for other vegetable oil.

■

Mexican Oil Seeds 1931

In the quarterly Review of Commerce and Industries of the March quarter of 1931, the coquito crop was estimated at 2,700 tons. The final figures obtained show the production at 2,800 tons. The season ended the present year in the month of May with the great majority of the crop being sent to Guadalajara.

■

The cod fishing season has come to an end, reports Commercial Attache Lund at Oslo, Norway, under date of July 16, 1931. Production of cod liver oil declined from 78,338 bbls. last season to 58,950 bbls. during the current season.

■

It was reported in a recent dispatch from Minister Eberhardt at San Jose, Costa Rica, that the leading crusher of oil seeds in Cuba had been instituting inquiries in Costa Rica concerning available supplies of oil seeds and nuts, presumably for export to Cuba.

■

Howard Kellogg, president of Spencer Kellogg and Sons, Inc., and of its grain elevator subsidiary, has purchased a seat on the Chicago Board of Trade.

OIL & FAT INDUSTRIES

The Editor's Page

For Greater Service

STARTING with the November issue, Oil & Fat Industries will be published as a section of Soap. The same technical and scientific material which has been a feature of Oil & Fat Industries in the past, will be continued in its pages as heretofore. There will be no change in personnel, management or policy of Oil & Fat Industries, merely a physical combination of the two papers. The broader field of the new and larger magazine will cover the technology of soaps, glycerine, oils and fats and allied products. Subscription lists of the two publications will be combined and the subscriptions of those who appear on both lists will be extended pro rata.

Oil Producers' Profits

FOR more than two years the country's soapmakers have been the beneficiaries of enormous overproduction of fats and oils of all kinds, with resulting low prices for all such commodities. The crusher and renderer have been the involuntary victims of these conditions and have only with the greatest possible exercise of economy remained afloat. Now opinion points to a change. Definite advances in the market prices of many of the soapmakers' raw materials must be expected in the near future, if only because of curtailment of whaling operations.

In recognition of this situation, leading soapmakers are already endeavoring to protect their positions by effecting economies in production and distribution costs, involving in some cases curtailment of wages and salaries among other means.

Producers of animal and vegetable fats do not desire that the soapmaker shall not have a fair profit, but they will be generally pleased to see world conditions so modified that they themselves can also once again obtain their fair margin of profit.

■

Consider First . . .

IN times of industrial retrenchment, there is always to be noticed a shifting of demand which is of even greater importance to the manufacturer than the accompanying reduction of total volume of consumption.

When security values have been severely weakened and dividends reduced or suspended, the income of that portion of the population which lives on the interest from invested capital is seriously curtailed. The salaries of the more highly-paid corporation officials are likewise generally reduced, as are the profits of most operators of retail businesses, and the income of professional men, whose prosperity is largely dependent upon that of the abovementioned groups.

All of these divisions of our population, taken as a whole, constitute what is known as the "quality" market. They are the purchasers who demand the utmost in package design and appearance, as well as in basic worth, of the merchandise they buy, and who generally insist on that superiority of quality and appearance, regardless of price. When the incomes of these purchasers are scaled down, they generally abstain as much as possible from buying, rather than accept cheaper goods of inferior quality.

The artisan and laborer, on the other hand, continue to receive an average wage much closer to their norm of prosperous times. These constitute the class of purchasers who seek plain value in the goods they buy. If the lard or margarine which they consume is pure and wholesome, they are not inclined to pay anything extra for frills.

In recognition of this trend, certain manufacturers of luxury articles are already making a bid for the patronage of this class of consumers by offering goods of high quality in plain containers of low cost. Such a policy will undoubtedly have some value in promoting sales of these luxury lines.

In the marketing of staples, however, such as salad oil, margarine, shortening and mayonnaise, there are so many diverse factors affecting distribution, that each individual manufacturer must decide for himself whether such modification of packing methods will influence his sales and profits favorably or otherwise.

Philippine Copra Market

Philippine copra price level showed upward tendency during the first half of July but lost what it gained during the second half and closed on same level as it opened due to decline in foreign purchases and increasing receipts. Receipts were over 30 per cent higher than during July of last year with production in the Southern Islands apparently improving. The uncertain German economic conditions were reacted on the oil market and brought cake and meal business to a standstill.

Copra arrivals at Manila were 380,428 Manila sacks and at Cebu 291,684 Cebu sacks. Exports in metric tons totaled 11,142 of which the United States took 8,602. Stocks on hand July 31st were 26,423 metric tons. Prices resecada at buyers' warehouse Manila pesos per picul, high, 5.375, low, 4.75.

Exports of coconut oil in metric tons totaled 16,766 of which the United States took 16,716. Stocks on hand July 31st at Manila 10,899 metric tons. Prices in drums at Manila pesos per kilo, high, .19, low, 1.17. Exports of Copra Cake and Meal totaled 9,438 metric tons of which the United States took 438 tons. Stocks at Manila July 31st metric tons 6,435. Prices F.O.B. steamer Manila, pesos per metric tons, high 36.50, low 33.50. (Cable from Trade Commissioner Hester at Manila.)

■

Elgin Softener Corp., Elgin, Ill., manufacturers of water conditioning equipment, is mailing a bulletin describing newly developed equipment for reducing blow-down losses in boiler operation. The Elgin Continuous Blow-Down System also minimizes concentrations and protects boiler surfaces according to the makers. A concise description of the system is available to interested companies.

■

Imports of flaxseed during the quarter were 97,226 tons in 1931, compared with 121,876 tons in 1930, and 254,171 in 1929. Imports of linseed oil were 124,586 pounds in 1931, compared with 1,673,558 in 1930, and 215,722 in 1929. Exports were 345,062 in 1931, 508,-084 in 1930, and 483,695 in 1929.

■

Soda ash exports from the United States in May, 1931, totaled 6,982,168 lbs., worth $102,467, Japan taking 3,405,740 lbs.

The Yangtze River basin has become an important producing region of sesame seed, and Shanghai has become one of the principal ports of export. All work in this region is done by hand due to the presence of cheap and plentiful labor, and the fact that the average Chinese farmer is not financially able to make use of agricultural machinery. During the past year, 1930, exports of sesame seed to the four most important countries were as follows:

	Pounds
Italy	50,403,940
Netherlands	16,783,980
Japan	46,583,635
United States	64,700,249
Other Countries	35,025,258
Total	213,497,062

Exports of sesame seed for 1927, 1928, and 1929 were 52,060,432 pounds, 80,270,660 pounds and 120,625,051 pounds respectively.

■

A large run of pilchards is reported off the West coast of Vancouver Island according to reports from fishing interests. The season for pilchard fishing opened on July 1, 1931, and the fish are reported to be thin and poor in oil, which is understood to be their usual condition at this time of year. Owing to the prevailing low prices for oil and the general market conditions only ten of the twenty-three West coast reduction plants in British Columbia are operating this season on pilchards.

■

Pressed Steel Tank Company, Milwaukee, manufacturers of Hackney steel barrels, drums, tanks and cylinders, announces the appointment of K. W. Cole as Chicago manager. The Chicago office is located at 208 South La Salle Street. Mr. Cole is well known to many business men, as a result of his long connection with American La France and Foamite Childs Corporation. He studied engineering at Cornell.

■

The Federal Specifications Board has officially adopted a specification for *Edible Olive Oil,* for all purchases of the commodity by all departments and independent establishments of the Federal Government. The specification becomes mandatory September 15, 1931. The symbol of this specification is *Z-O-351,* and copies may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C., for 5 cents per copy, cash or money order accompanying request.

Oil Chemists' Fifth Annual Fall Meeting

Gathering at Chicago This Month Promises Most Interesting Scientific Program and Attractive Entertainment Features

"ON TO CHICAGO" is the watchword of oil and soap chemists throughout the country this month. The Fifth Annual Fall Meeting of The American Oil Chemists' Society will convene at the Congress Hotel, Michigan Boulevard, Chicago, on Thursday and Friday, October 29 and 30.

President A. S. Richardson, of Cincinnati and the Chicago Local Arrangements Committee, W. H. Irwin, *Chairman,* promise that this year's Fall Meeting will be second to none in amount and quality of scientific material presented. John P. Harris, *Chairman* of the Entertainment Committee has arranged a mammoth bowling tournament and other attractive features which will insure a complete absence of dull moments. The interests of the ladies attending the meeting will be cared for by a special committee of Chicago ladies, headed by Mrs. Harris as *Chairman.*

There will be extensive exhibits of chemicals, apparatus, machinery and supplies, of interest to all technical men associated with the oil and soap industries. The exhibits will be displayed in the Florentine Room of the Congress Hotel, where the sessions of the meeting will be held.

The excursions to manufacturing plants which have been arranged by the Local Committee will be of particular interest. Visits to the various packing plants and the stockyards and a trip to Hammond, Indiana to inspect the new $5,000,000 modern soap manufacturing plant of Lever Brothers Company have been arranged. A visit to the famous Planetarium in Grant Park, Chicago, where the courses of the celestial bodies are represented in miniature, has also been provided for.

On the Saturday following the meeting there will be two important football games in Chicago, the Chicago-Purdue and the Northwestern-Illinois games. Those desiring tickets to attend either of these games are requested to write promptly to W. H. Irwin, Swift & Co., Chicago, who will secure tickets for the games.

Mayor Andrew J. Cermak of Chicago has promised to attend the first session of the meeting, accompanied by the city's Official Greeter, Colonel Gaw. It is expected that both the Mayor and Colonel Gaw will address a few words of welcome to those attending the meeting.

■

FIFTH FALL MEETING
of
THE AMERICAN OIL CHEMISTS' SOCIETY
Congress Hotel
Chicago, Ill., October 29-30, 1931

President
A. S. Richardson, Cincinnati, O.

Vice-Presidents
N. C. Hamner, Dallas, Tex.
J. C. McMillan, Atlanta, Ga.
A. K. Schwartz, Houston, Tex.
A. Campbell, Cincinnati, O.

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W. A. Peterson, Sec'y Soap Section, Brooklyn, N. Y.

Official Journal
OIL AND FAT INDUSTRIES
Alan P. Lee, *Editor*

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Chicago Local Committee
W. H. Irwin, *Chairman*
J. P. Harris, A. W. Putland, J. J. Vollertsen, L. M. Tolman, M. L. Sheely, A. E. King.

Ladies Entertainment Committee
Mrs. J. P. Harris, *Chairman*
Mrs. J. J. Vollertsen, Mrs. M. L. Sheely, Mrs. R. W. Perry, Mrs. L. M. Tolman, Mrs. A. W. Putland.

ANNOUNCEMENTS

1. The Fifth Fall Meeting of the American Oil Chemists' Society will be held in Chicago, October 29 and 30, at the Congress Hotel, Michigan Blvd., and E. Congress St.

2. Members and Guests are cordially invited to attend.

3. The Congress Hotel will be the headquarters and we urge all who attend to make reservations on the reservation card enclosed with the program.

4. Special trips to plants of interest have been arranged by the Local Committee. When registering please indicate what trips you desire to take.

5. There will be informal luncheons in the Pine Room of the Congress Hotel on both Thursday and Friday for members and guests. Make your reservations for these luncheons at the registration desk.

AMUSEMENTS

A special Ladies Committee has been appointed and has made suitable arrangements to see that the ladies attending the convention are properly entertained.

Friday night space has been reserved at the Planetarium for an American Oil Chemists' Society group. We urge all of you to take advantage of this opportunity to see an interesting and unusual sight.

The Annual Bowling Tournament, under the management of J. P. Harris, will again be a feature of the convention. This Bowling Tournament is to take place Thursday night, October 29, at the Bensinger Alleys, 31 E. Congress St. There will be an opportunity for five-men teams and singles. Give Mr. Harris your entry promptly.

Tickets for the Chicago-Purdue and Northwestern-Illinois games may be secured by application to the Local Committee. Do not wait until the time of the Convention before making reservations.

If the weather is suitable, arrangements will be made for those who care to play golf.

REGISTRATION

Registration will take place between 9:30 and 10:00 A.M. Thursday morning, October 29. There will be a nominal registration fee ($1.00) to take care of incidental expenses of the convention.

EXHIBITS

Provision has been made for exhibits of chemical apparatus, supplies, and machinery.

PROGRAM

Thursday, October 29, 1931

Registration 9:30 to 10:00 A.M.

Meeting called to order at 10:00 A.M. by President A. S. Richardson.

Address of welcome by Mayor A. J. Cermak.

Meeting turned over to Archibald Campbell, Chairman of the Soap Section.

COMMITTEE REPORTS

1. Report of the Detergents Committee—J. G. Vail, Philadelphia Quartz Co., Philadelphia, Pa.

2. Report of the Glycerin Analysis Committee—J. T. R. Andrews, Procter & Gamble Company, Ivorydale, Ohio.

3. Report of the Soap Analysis Committee—M. L. Sheely, Armour Soap Works.

PAPERS

1. "Soap Phases," R. H. Ferguson, Procter & Gamble Co., Ivorydale, Ohio.

2. "Light Colored Saponified Fatty Acids," R. B. Trusler, Davies-Young Soap Company, Dayton, Ohio.

3. "Notes on Power Laundry Practice," C. E. Lennox, Swift & Company, Chicago, Ill.

4. "Studies in the Comparison of Detergents," W. H. Burkhart, Gold Dust Corporation.

5. "The Determination of Water in Soaps," A. K. Church, Lever Brothers Company.

6. "Activated Carbons, their Production and Uses," J. Wrench, Industrial Chemical Sales, New York City.

7. "A New Method of Rendering," O. H. Wurster, Wurster-Sanger Company, Chicago, Ill.

SPECIAL ANNOUNCEMENTS

Adjournment

Informal Luncheon—Pine Room, Congress Hotel.

The afternoon will be devoted to trips to various industrial plants.

Bowling Tournament — 8:00 P.M. — Bensinger Alleys.

PROGRAM

Friday, October 30, 1931

Meeting called to order at 10:00 A.M. by President A. S. Richardson.

PAPERS

1. "Changes in Edible Oils and Fats due to Atmospheric Oxidation," H. Aspegren, Norfolk Research Corporation, Norfolk, Va.

2. "A Process for Refining and Deodorizing Oils," V. Conquest, Armour & Company, Chicago, Ill.

3. "Oils and Fats as Food for Mammals and Micro-organisms," L. B. Jensen, Swift & Company, Chicago, Ill.

4. "Some Observations on Oil Refining in Europe," R. W. Perry, William Davies Co., Chicago, Ill.

5. "Feed Control and Some Recent Developments," H. A. Halvorson, Minnesota State Department of Agriculture, St. Paul, Minn.

6. "The Significance of the Recent Rapid Growth in Whale Oil Production," R. W. Harrison, Bureau of Fisheries, Gloucester, Mass.

7. "The Technology of Whale Oil," A. P. Lee, MacNair-Dorland Co., New York, and H. P. Trevithick, Bureau of Chemistry, New York.

8. "Commercial aspects of the Uses of Sunflower Seed Oil, Sesame Oil, and Soya Bean Oil," G. G. Fox, Armour & Company, Chicago.

9. "Mayonnaise Oils, Mayonnaise, and the Kreis Test," A. G. Olson, General Foods Corporation, and C. A. Southwick, Jr., General Foods Corporation.

SPECIAL ANNOUNCEMENTS

ADJOURNMENT

Visit to the Planetarium—8:00 P.M.

Saturday, October 31, 1931

Amusements—Golf, football, etc.

Rancidity Accelerated by Porous Packings

Some Observations on the Effects of Various Layer Boards on Rancidity in Baked-goods Shortenings*

By WILLIAM RABAK[1]

THE unusually long and hot summer of 1930 was the direct cause of numerous rancidity troubles in the baking trade. Numerous complaints emanated throughout the summer in regard to certain types of baked goods packed in cardboard cartons. Rancidity was found to be particularly prevalent in cartons containing cookies with a high shortening content. Investigation of the types of shortening used in the goods in question indicated that of the three types of shortening employed in the manufacture of biscuit and cracker products, considerably more trouble was experienced in cartons containing goods manufactured with the use of oleo oils and lards than those manufactured from all hydrogenated shortenings. With this information in hand, an investigation was conducted in an effort to determine the principal factors which appeared to be the cause of this premature rancidity development.

Critical examinations of the lards and oleo oils employed in the manufacture of the goods in question revealed the fact that, from the standpoint of keeping properties, these shortenings appeared to be normal in every respect. Attention was then directed to other features which might possibly be responsible for the trouble.

It was noted that in each case where distinct rancidity was observed in the carton, the layer boards between the cookies were heavily impregnated with fat apparently absorbed from the goods packed in the carton. This led to the supposition that the rancid odor in the carton might possibly be due to rancidity developed in the fat-impregnated layer board rather than in the goods themselves. Aeration of the goods removed from the carton proved in most cases that the odor could be dissipated from the goods. Examination of the layer boards in these cartons indicated that rancidity had developed *in the fat soaked card board.* This led to the theory that certain types of layer boards might possibly have a greater rancidity accelerating effect on the absorbed fats than others. For this reason it was decided to collect a number of different types of layer boards used regularly in packing biscuits of the sweet goods type. Accordingly arrangements were made for the collection of 30 samples of layer boards. These samples were found to represent 8 distinctly different types of cardboard, and the work done on this problem was confined to these representative types.

The following cardboards were included in the study:

1. Solid pulp board, plain (soft finish)
2. Solid pulp board, silicated (soft finish)
3. Filled pulp board (hard finish)
4. Solid news board (hard finish)
5. Patent white and news back board
6. Solid news board—Manila lined
7. Double Kraft board, asphalt filled
8. Solid news board — silica and waxed one side

The following method was employed to study the relative rancidity resistance of these different layer boards when stained with fat:

> Eight square inches of each board was impregnated with 2 c.c. of melted fat and the board was folded and placed in a clean Mason jar. It was then subjected to the accelerated keeping test which is ordinarily employed to determine the rancidity resistance of fats. This consists in exposing the fat under examination to a temperature of 145° F. in an electrically heated cabinet. Periodically these jars were removed and examined, by noting the odor, for evidences of rancidity.

The experiment was conducted with 3 different fats, a prime steam lard, an open kettle lard, and a No. 1 oleo oil. The relative resistance to rancidity development of the

* Presented at Annual Meeting American Oil Chemists' Society, New Orleans, May, 1931.

[1] *Technical Institute Laboratory, Biscuit and Cracker Manufacturers' Association.*

various types of board was the same with the 3 different fats. It might be mentioned that the keeping properties of the boards impregnated with oleo oil were somewhat superior to the boards treated with the two lards.

The reaction of the water extract prepared from each of these boards was also studied. This was done on the assumption that the residual chemicals in a layer board might in some way be associated with rancidity acceleration. The range of reaction of the water extracts on these papers was from pH 5.2 to 8.8. It appeared that the lower pH values were characteristic of solid pulp boards while the news boards were found almost invariably to have a higher pH value on the alkaline side. No relationship was found between the reaction of the board and the keeping properties of the fat absorbed by the board.

It was observed in each case where rancidity developed in a short period of time that the board was of a porous nature with a soft finish. For this reason the solid pulp boards were less resistant to rancidity than were the solid news boards or other boards having a harder and more impervious surface. The use of silicate on the solid pulp board did not appear to have much effect towards retarding rancidity development. In fact, in one case the silicated solid pulp board showed less rancidity resistance than did the ordinary solid pulp board. The reason for this is not at all clear unless it be possible that silicate acts as a catalyst or "hastener" of rancidity. Generally speaking, it was found that the boards which absorbed the melted fat the most slowly were the most resistant to the development of rancidity regardless of the type of stock from which they were manufactured. For example, the boards which were first silicated and then waxed were found to be quite resistant. Likewise the sample of board manufactured with the use of asphalt filler and double Kraft paper was found to be unusually resistant.

The result of this study on the rancidity resistance of the various boards may be summarized as follows:

1. The porosity of a layer board determines to a great extent its rancidity resistance. The porous boards, such as the plain solid pulp boards, were invariably found to hasten rancidity development. This can be explained by the fact that this type board when impregnated with fat exposes a greater area to the action of the air.

2. Layer boards having a ***hard finish*** appear to be more resistant to rancidity devolopment when treated with fat. The advantage of the hard finished boards is likely due to the fact that they are less porous and absorb less fat. The type of stock from which the hard finished boards are manufactured apparently does not affect the rancidity development of the fat.

3. The use of silicate alone applied to a porous type of board does not improve its rancidity resisting properties. However, the use of a combination of silica and wax was noted to have a decided effect towards improving rancidity resistance.

4. The amount of residual chemicals in the various types of board as indicated by the pH of the water extract apparently has no connection with the rancidity hastening effect of laver boards.

This investigation of the rancidity resisting properties of layer boards demonstrates that the selection of the proper layer board is important especially during the summer months. It appears that the safest procedure to follow in selecting layer boards for packaging goods high in fat content is to eliminate the soft finish, porous type boards.

■

Mayonnaise Containers

The Division of Simplified Practice of the Bureau of Standards, Department of Commerce, has mailed to all manufacturers of mayonnaise and allied products, a summary report of the recent general conference of the division on simplification of glass containers for mayonnaise and kindred products. The recommendation of the conference is that *sizes* of such glass containers be limited to five in number: the 3 fluid ounce, half-pint or eight fluid ounce, pint, quart and gallon sizes.

The Bureau of Standards has requested the adherence of all manufacturers of mayonnaise and kindred products to the recommendation of the conference as to sizes of glass containers, and any manufacturer who has failed to receive a copy of the conference report is urged to write the Bureau for such copy and a blank form for the registry of his assent with the Division of Simplified Practice.

Especial attention is directed to the fact that reduction in the number of *sizes* of glass containers used by the mayonnaise industry is not intended in any way to affect the variety or individuality of *design* of containers which may be used by various producers.

■

Cacao butter consists entirely of the glycerides of palmitic, stearic and oleic acids. Any addition of fat containing lower fatty acids can be detected by isolation of these lower acids. *Z. Untersuch. Lebensm.* 60,327-31, *Chem. Abstr.* 25,3857 (1931).

A. O. C. S. Bowling Tournament

The twelve fastest and smoothest alleys in the city of Chicago, at 235 South Wabash Avenue, just around the corner from the Congress Hotel, have been secured for the Second Annual Bowling Tourney of The American Oil Chemists' Society, October 29th.

Play will be resumed for the Nuchar Challenge Trophy Cup, won last year by the Amaizo team of The American Maize Products Co., and this year the eligibility rules have been so tightened up that a good stiff competition, in doubt to the last minute, is assured.

All contestants must be actually employed in the chemical laboratory or in some department of the plant where actual processing of fats, oils or soaps is done, and at least one member of each team must be a member of The American Oil Chemists' Society, in good standing. Exhibitors at the convention are also eligible for competition.

In addition to the Nuchar Challenge Trophy, herewith shown, there will be several other prizes, including individual high single game, and high three games, also illustrated.

One of the most dangerous teams last year was the Procter and Gamble team of Cincinnati, and we understand that, in spite of extreme heat, this team has started preliminary practice on the Wyoming alleys, headed by President Richardson of the Society. They will be a hard team to beat this year. They are all eligible.

The Armour team will bear watching this year, as they turned in the highest single game of the year last year and we hear that John Vollertsen has had them out practicing regularly. The Swift Premiums form one of the best teams we have ever seen in competition.

Such exceptional interest has been shown in this tournament that nine entries have been received for five-man teams already, including the Swift Premiums, the Armour Stars, the Wilson Certified, the Industrial Chemical Nuchars, the Swift Vreams, the Armour Soap Works Luxors, the A. Daiggers, the Swift Silverleafs, and the Procter & Gamble Criscos. Entries are expected from the American Maize Products Company Amaizos, and the Lever Brothers Lux, so that the 12 alleys originally reserved appear to be insufficient and reservation has been made up to 18 alleys, or two solid floors, at 235 South Wabash Avenue, and entertainment features will be provided so that everyone will have a good time. There will be alleys available for singles and two-men teams and for the ladies and there will be prizes for all and a surprise handicap, which will provide a lot of laughs.

A. O. C. S. Bowling Challenge Trophy

It will assist the bowling committee greatly if the members will send in reservations for the alleys promptly, so that no one will be disappointed, because if the 18 alleys provided for do not prove sufficient, the committee wants to know in plenty of time to provide more. Please send reservations in at once to:

John P. Harris,
205 W. Wacker Drive—Room 1306
Chicago, Illinois.

The Committee sincerely hopes that every chemist in attendance at the meeting will bowl with us as this will be a strictly informal bowling affair, so that it will not require those bowling to bring their own bowling ball or even their own bowling shoes, so if they happen to slide over the foul line a little bit, they are not going to be penalized, because the purpose of the occasion is just to get together in an informal way and there is no place where good fellowship can be promoted as it can on the bowling alleys. There will be plenty of prizes for all and the biggest prize of the evening will go to the winner of the surprise handicap, so that it is quite possible that one of the bowlers making a poor score will take home the prize, which is sure to please the winner.

Copra and Coconut Oil in the Netherlands East Indies

Plantations and Local Crushing Plants Growing in Importance Despite Present Slackening of Demand

By CARL H. BOEHRINGER*

THE Netherlands East Indies is one of the leading countries producing copra for local consumption and for export. For many years it has been supreme in copra production, being seconded by the Philippine Islands. The available comparative statistics for 1930 indicate that the Netherlands East Indies is maintaining this premier position.

The cultivation of coconut palm trees in the Netherlands East Indies is primarily in the hands of the natives of the Outer Possessions, principally in Celebes, Borneo and Sumatra. Scattered throughout the vast archipelago, however, there are European estates concerning which production data are available. According to the official "Landbouwexport Gewassen van Nederlandsch Indie in 1929), (The Export Crops of the Netherlands Indies in 1929), published by the N. E. I. Central Bureau of Statistics, the estate production was as follows during the years 1925 to 1929. No figures are available for 1930.

Copra Estate Production, N.E.I.
(In metric tons)

	Java and Madura	Outer Possessions	Total N.E.I.
1925	2,547	14,405	16,951
1926	2,077	15,505	17,582
1927	2,018	15,951	17,969
1928	3,534	19,805	23,339
1929	4,171	20,306	24,477

The total acreage under cultivation to the coconut palm in the Netherlands East Indies at the end of 1929 was 51,655 hectares. Only 50% of this acreage is in production however, as estate cultivation is just getting under way and no rapid expansion is expected. During 1929, the estates produced 8,520,224 coconuts (equal to 1,982 metric tons of copra), while 38,735 piculs (2,392 tons) of copra were bought from the natives by the estates.

According to the N. E. I. Department of Agriculture, Commerce & Industry, it is impossible to give any accurate figures regarding the native production of copra. The probable exports of native copra from the Outer Possessions to foreign countries were as follows during the years 1927 to 1929. For comparative purposes, the total exports are also given.

Probable Exports, Native Copra, N.E.I.
(Estimate in metric tons)

Year	Estimated Native Exports	Total Copra Exports
1927	309,819	309,467
1928	395,405	439,299
1929	396,781	445,895
1930	(not available)	375,522

The probable native export figures include the exports of coconut oil and fresh coconuts, calculated into tons of copra. This does not give any insight, however, into the entire native copra production since the native consumption has not been taken into consideration. The only reliable figures obtainable regarding native copra production are given in "De Landbouwexport Gewassen van Nederlandsch Indie in 1929." According to this publication, from the figures covering the exported copra and the copra which has been worked into coconut oil and copra cake, it is possible to estimate the Java and Madura native copra production.

Estimate, Native Copra Production, Java & Madura

1929	241,200	metric tons
1928	222,600	" "
1927	107,400	" "
1926	131,200	" "
1925	136,500	" "

The quantity of coconuts consumed in the homes of the natives in Java and Madura is unknown. It has been estimated at about 9.7 kilograms per person annually. According to the 1930 census, Java and Madura have a population of 41,719,524 (total N. E. I. population—60,731,025) and if 9.7 kilograms per person annually is taken as a correct estimate, it may be said that the home consumption of coconuts in Java and Madura approximates 404,679,383 kilograms annually. The local consumption of coconuts does not keep steady. Agricultural experts state that a favorable rice crop causes a greater consumption while a poor rice crop causes a decreased consumption of coconuts. This is undoubtedly due to the fact

*U. S. Assistant Trade Commissioner at Batavia, Java.

Theoretical Total Exports, Copra, N.E.I.
(in copra equivalent of m. tons)

	Coconut Oil	Coconuts	Copra*	Theoretical Total
1929	51,860	66	456,869	508,795
1928	55,199	13	440,851	496,063
1927	14,555	32	305,277	319,864
1926	24,936	48	376,882†	401,866
1925	15,660	36	351,010	366,706

* Actual N.E.I. Exports.
† Gross weight—all others net weight.

that coconut meat is used in many forms as a dressing for the rice.

The Netherlands East Indian Department of Agriculture, Industry and Commerce estimates (in "De Landbouwexport Gewassen) the consumption of coconut products in Java and Madura to have been as follows during the years 1924 to 1928. The figures are given in terms of copra equivalents.

Estimate, Consumption Coconut Products, Java and Madura

1928	362,000	metric	tons
1927	362,000	"	"
1926	350,000	"	"
1925	347,000	"	"
1924	344,000	"	"

The theoretical total export of copra from the N. E. I. is another figure which is estimated by the Netherlands East Indian Department of Agriculture, Commerce and Industry. The exports of oil and nuts are converted into the copra equivalents.

Exports of Copra 1st Quarter 1931

SHIPMENTS of copra from Java and Madura were 969 metric tons (first quarter 1930—5,126 metric tons). The Outer Possessions exported 105,286 metric tons during the first three months of this year (corresponding quarter 1930—89,142 metric tons) making a total for the N. E. I. of 106,255 metric tons (first quarter 1930—94,538 metric tons).

53% of the exports were from the Celebes Islands and their dependencies while 16% were from western Borneo showing that the bulk of the copra is produced in the eastern section of the N. E. I. Essentially the same precentages ruled for export movements in the first quarter of 1930. Macassar (Celebes) handled approximately 23% of the exports (first quarter 1931) and has been far in the lead of all other parts of the N. E. I. in recent years. Other ports in order of importance with percentages of export movement during first quarter of 1931 were Gorontalo (Celebes) 13½% and Pontianak (Borneo) 10%. A number of other ports were of lesser importance as shipping centers.

During the first quarter of 1931, Holland (with 21%) continued to take more copra than any other foreign country. France took 17% of the total exports, this percentage being unchanged compared with the same quarter in 1930; Germany dropped from 18% to 14%; while British Malaya rose from 12% to 15% and the United States from 9% of the total exports to 10%.

Export Duty

AN EXPORT duty is levied on every 100 kg. of copra exported. This duty amounts to 8% of the difference between the average market price and the average cost price increased by 10%. By decree of the Director of Finance, the average market price and cost price are fixed at regular intervals and upon these figures the export duty is based. On January 19, 1931 the Director of Finance decreed the average cost price of copra to be Fl. 12.50 (U. S. $5.00) per 100 kg. effective during the second quarter of 1931 and until further notice. The average market price during the second quarter has been decreed to be Fl. 13.35 (U. S. $5.34) per 100 kg. There is no export duty during the first, second, and third quarters of 1931 due to the low market prices. During the fourth quarter of 1930, the export duty amounted to U. S. $0.112 per 100 kg. of 220 pounds, against U. S. $0.12 during the third quarter of the same year.

Average prices on the Batavia market were as follows for F. M. S. (Fair Merchantable Sundried) copra during the first quarters of 1931 and 1930, respectively:

	Per 100 kg. excluding gunny bags 1931	1930
January	US$5.55	US$8.48
February	5.28	8.42
March	5.35	7.87

In this connection it may be noted that the average price for the F. M. S. copra on the Batavia market was U. S. $10.79 in 1926; U. S. $10.09 in 1927; U. S. $9.61 in 1928; U. S. $8.44 in 1929; and U. S. $7.21 in 1930. Copra prices were lower in 1930 than at any time since 1913.

Prevailing Market Trends

IN THE face of decreased foreign demand; there is noted at the present time, as well as during the first quarter, an appreciable increase in native copra production brought about to a

very large extent by the low rubber prices. This trend is particularly true in Sumatra and Borneo. In Celebes, on the other hand, the increased production is very likely due to the coming into bearing of new plantings. The consumption of copra in Java is undoubtedly likely to increase, the copra being used to an increasing extent by the copra crushing mills. It is reported that during 1930 great advance was made in distributing factory made coconut oil not only in Java but in most parts of the Outer Possessions.

According to the N.E.I. Statistical Abstract for 1929, there were at the end of 1929 a total number of 85 copra mills in the entire country. The bulk of the coconut oil mills are located in Java and Madura, only 37 small plants being located in the Outer Possessions.

According to an apparently reliable source (Dr. W. L. Wolff writing in his magazine entitled "Olien, Vettem & Oliesaden" and reprinted in the "Algemeen Landbouwweekblad van Nederlandsch Indie" on May 23, 1931) more than 90% of the coconut oil production in the Netherlands East Indies is in the hands of Europeans and 10% in the hands of Chinese. The European share is controlled by not more than six concerns. There are other smaller European companies but they take but a small share of the copra which is crushed into oil.

The official Government publication "De Landbouwexport Gewassen van Nederlandsch Indie in 1929" contains the following table showing the amount of factory coconut oil produced in Java during the years 1924 to 1929 inclusive. It also shows the exports to foreign countries and to other parts of the Netherland East Indies and the amount remaining for local consumption. No 1930 figures are available.

In connection with the Outer Possessions, exports of coconut oil from Java to these regions have steadily increased. In addition to the Java product, coconut oil is imported into the Outer Possessions (mostly into Sumatra) from British Malaya, principally from Singapore and Penang. The only part of the Outer Possessions to have any appreciable amount of coconut oil available for export are the two islands Bali and Lombok, which in 1929 shipped 1,367,618 liters to foreign countries. Exports to foreign countries for the first quarter of 1931 were 1,115,000 liters (corresponding period 1930—7,093,000 liters).

During the first quarter of 1931, exports of copra cake totaled 11,922 metric tons of which 10,987 tons were shipped from Java. These figures indicate that the Netherlands East Indian coconut oil production was fairly well maintained during the first quarter even though the exports of coconut oil fell heavily during the period under review. Exports to Belgium constituted about 50% of the total movement to foreign countries during the first quarter of 1931. Holland was a buyer of 27% and Germany 17%.

Java Production, Exports and Consumption, Coconut Oil
(all figures in 1000 liters)

Year	Production	Exports			Consumption Java	
		Abroad	Other N.E.I.	Total	Total	Per Capita Liters
1929	138,156	34,433	7,689	42,122	96,034	†
1928	136,049	36,624	4,860	41,484	94,565	2.53
1927	96,444	9,649	2,347	11,996	84,448	2.26
1926	87,266	16,502	2,483	18,985	68,281	1.89
1925	78,548	10,387	2,919	13,306	65,242	1.83
1924	54,354	7,935	1,845	9,780	44,574	1.26

† Not estimated.

"Trichlorethylene, Its Properties and Uses," is the title of a booklet recently issued by The Roessler & Hasslacher Chemical Co., Inc., of Niagara Falls, New York. The booklet discusses in detail the extraction of oils and fats by means of this non-inflammable solvent. It is stated that the solvent is non-corrosive to iron, steel, copper, lead, aluminum and tin at elevated temperatures and in the presence of water. Its physiological action is claimed to be milder than that of gasoline or chloroform and to be non-cumulative in its effect on the human system from inhalation of fumes.

The use of trichlorethylene for the extraction of fats is said to be growing rapidly, it having been applied successfully to the extraction of olive oil, cacao butter, corn oil, linseed oil, soybean oil, cottonseed oil and other oils, as well as to the recovery of greases from leather, bones, tankage, etc.

A preservative bath for wood is prepared by mixing a drying oil such as linseed oil, with 7.5% of linoleic acid or other drying-oil acid, and incorporating 1% of a glycerol solution of boric or salicylic acid, calculated on the oil, into the mixture. Austrian Pat. No. 122,507.

Oil Chemists' Committees

President Richardson Announces Personnel of Organizations Detailed to Carry Forward Society's Co-operative Work

A. S. RICHARDSON, President of The American Oil Chemists' Society, has announced the appointment of complete membership of most of the standing committees of the Society for the current year. The chairmen of the major committees are in most cases the same members who have served so faithfully in such capacities for one or more years in the past.

The President is chairman of the Governing Committee, according to the custom of the society. W. H. Irwin, of Swift and Company, has been persuaded to remain as chairman of the Referee Board for another year. The Uniform Methods and Planning Committee continues under the able leadership of J. J. Vollertsen, of Armour and Company, and C. B. Cluff of The Procter and Gamble Company remains at the head of the Refining Committee. The work of the Detergents Committee and the Fat Analysis Committee will continue under the direction of James G. Vail and W. D. Richardson, respectively.

New names in the list of chairmen include N. C. Hamner, Membership Committee, and M. L. Sheely, Soap Analysis Committee. The Glycerine Analysis Committee will continue its excellent work of last year under the leadership of the same chairman, J. T. R. Andrews, and M. F. Lauro remains at the head of the Olive Oil Committee. The full list of committees as announced by President Richardson to date follows:

GOVERNING Committee: A. S. Richardson, *Chairman,* The Procter & Gamble Company, Ivorydale, Ohio, W. H. Irwin, W. R. Stryker, A. W. Putland, H. P. Trevithick, N. C. Hamner, J. C. McMillan, A. K. Schwartz, A. Campbell.

Referee Board: W. H. Irwin, *Chairman,* Swift & Company, Chicago, Ill., H. Aspegren, L. C. Haskell, F. Paquin, A. S. Richardson.

Uniform Methods & Planning Committee: J. J. Vollertsen, *Chairman,* Armour & Company, Chicago, Ill., A. Campbell, C. B. Cluff, J. D. Evans, H. P. Trevithick.

Refining Committee: C. B. Cluff, *Chairman,* The Procter & Gamble Company, Ivorydale, Ohio, E. R. Barrow, R. H. Fash, J. J. Ganucheau, R. C. Hatter.

Membership Committee: N. C. Hamner, *Chairman,* Southwestern Laboratories, Dallas, Texas, J. P. Harris, A. P. Lee.

SOAP Analysis Committee: M. L. Sheely, *Chairman,* Armour & Company, Chicago, Ill., W. H. Burkhardt, A. K. Church, M. H. Ittner, C. P. Long, W. A. Peterson, W. D. Richardson, L. M. Roeg, F. W. Smither, H. P. Trevithick, R. B. Trusler.

Glycerin Analysis Committee: J. T. R. Andrews, *Chairman,* The Procter & Gamble Co., Ivorydale, Ohio, R. W. Bailey, A. K. Church, J. C. Gundel, L. F. Hoyt, M. W. Ittner, J. W. Laurie, W. A. Peterson, W. D. Richardson, M. L. Sheely, C. M. A. Stine.

Olive Oil Committee: M. F. Lauro, *Chairman,* Bureau of Chemistry, New York Produce Exchange, New York, N. Y., L. G. Copes, W. H. Dickhart, A. H. Gill, G. S. Jamieson, S. Musher, M. L. Sheely, W. F. Whitmore.

DETERGENTS Committee: J. G. Vail, *Chairman,* Philadelphia Quartz Company, Philadelphia, Pa., W. D. Appel, H. C. Bennett, W. H. Burkhardt, A. K. Church, L. F. Hoyt, L. T. Howells, E. B. Millard, H. S. Mitchell, C. J. Post, W. C. Preston, F. H. Rhodes, M. L. Sheely, F. D. Snell, F. W. Smither, W. R. Stryker, P. H. Walker.

Fat Analysis Committee: W. D. Richardson, *Chairman,* Swift & Company, Chicago, Ill., R. W. Bailey, T. C. Law, C. P. Long, H. J. Morrison, M. L. Sheely, L. M. Tolman, H. P. Trevithick, J. J. Vollertsen, D. Wesson.

(*Turn to page* 397)

Forming and Pressing Cakes in the Oil Mill

Satisfactory Extraction Results in Cottonseed Milling Largely Dependent upon Press Room Procedure*

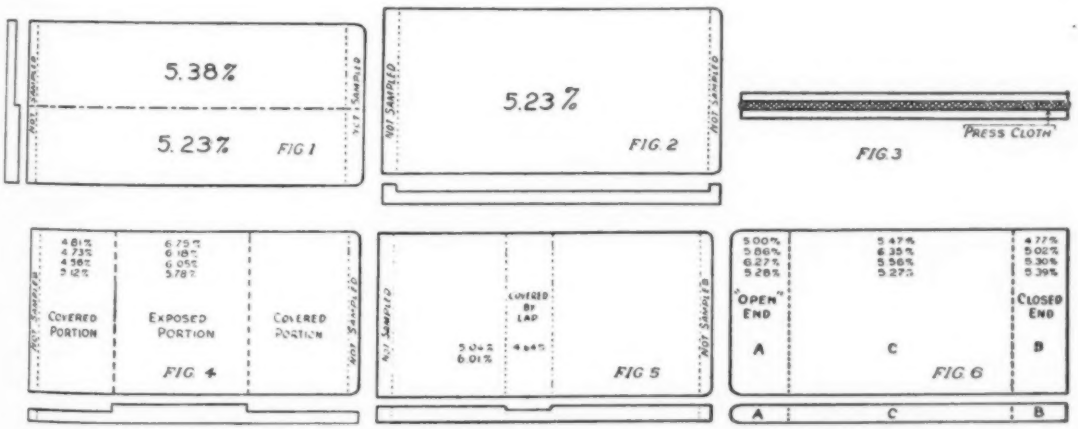
By James G. Gibson

THE proper forming and pressing of cakes is one of the factors in cottonseed oil milling which heretofore we have been prone to neglect. In reality we find that herein lies the secret of better extraction. Often the cooker is blamed for poor work when the fault really lies in the former or press, or rather in the way they are handled. One usually finds that as long as the meats are cooked reasonably well, good extraction may be obtained, provided the other factors in the press room are under control.

Since you are familiar with cottonseed oil mill machinery it will not be necessary to give any description or explanation of the equipment used. The purpose of the former is to form a cake in such a manner that when placed under pressure in the press the highest possible oil yield can be obtained. The press, with its accompanying change valve, is intended to so apply this pressure as to give the maximum oil yield with the lowest press cloth and power expense.

During the past season while operating our experimental plant we obtained some interesting data which served to impress upon us the importance of proper forming and pressing. At different times we have been shown sketches and charts showing the location of the oil in the cake. I might say, in a cake, since you will probably find that there is a wide variation between cakes even when taken from the same pressing. We usually find, however, that a cake made in a closed-end press box ranges in extraction from low at the closed end through lower under the lap or in the middle of the cake to very high in the three or four inches at the open or "oily" end. With the idea in mind of determining whether or not cakes should have better drainage facilities, the following tests were made:

Figure 1 represents an attempt to show a comparison in the same cake, between one of normal thickness and one made somewhat thinner by an extra thickness of press cloth the length of the cake and one-half as wide, placed on top of the meal in the former tray



*Presented at Annual Meeting, American Oil Chemists' Society, New Orleans, May, 1931.

before folding the cloth. This cake was pressed and stripped and the two halves separated and analyzed. The "oily" portion of each end was discarded. Here we see a difference of only 0.15% in extraction which can be considered as negligible, being within the limit of analytical error.

Figure 2 shows a whole cake made by placing an extra thickness of cloth the size of the cake on top of the meal in the former tray. This cake was made at the same time as that in Fig. 1 and the analysis 5.23% oil agrees with that of the thicker half of the cake in that sample. This would indicate that the thickness of the cake, within certain limits at any rate, has little to do with the extraction.

Figure 3 represents a cake separated into two very thin wafers by the insertion of a strip of press cloth between two layers of meal in the former as the cake was made. After pressing, the two layers were stripped and ground and for comparison the entire cake in the adjacent box was ground and analyzed. The analysis showed that the two wafers contained 4.93% oil while the normal cake analyzed 5.26%.

Going into this further we made a number of light and heavy cakes by varying the depth of meal in the former. In each case a similar result was obtained, there seldom being a difference of more than one-half of one per cent of oil between the samples. However, this difference is sufficient to show that we must expect to sacrifice some oil in order to secure the greater tonnage through the mill.

Figure 4 shows the effect of cutting the press cloth too short. The portion left uncovered due to the short cloth did not receive the same pressure and drainage that the rest of the cake did. Sample cakes were prepared using different lengths of cloth so as to vary the amount of cake left exposed. These analyzed as follows:

Sample	Oil in Cake Under Cloth	Oil in Exposed Portion	Difference
1. 12″ Exposed	4.81%	6.75%	1.94%
2. 5″ Exposed	4.73	6.18	1.45
3. 12″ Exposed	4.56	6.05	1.49
4. ½″ Exposed	5.12	5.78	.66

Which may explain the poor press room work at some mills.

Figure 5 is a sketch showing the analysis of a cake covered completely with cloth. Here we find that the analysis of that portion immediately under the lap is considered lower than that in the adjacent parts. In the case of extremely long laps we note quite a difference. This is probably due to the unequal pressure caused by the double thickness of cloth at the lap.

An interesting test to apply to the slab cake from any mill is to separate average samples of cake into strips as shown in Fig. 6 and analyze these for oil. For instance, a number of cakes were selected from different lots of slab as produced, and each group of cakes was broken into three parts as shown in the sketch.

Figure 6 shows the results of analysis of four different lots of cake in this manner:

	1st	2nd	3rd	4th
% Oil in Open End	5.00	5.86	6.27	5.28
% Oil in Closed End	4.77	5.02	5.30	5.39
% Oil in Remainder of Cake	5.47	6.35	5.56	5.27

Tests No. 1 and No. 2 show the result of improper forming, the cake being thick at the ends and thin in the middle. This prevented the middle of the cake from receiving the proper pressure and at the same time put an undue strain on the press cloth at the ends. The third test represents more of an average cake. Naturally we expect the highest oil in cake to be at the open end of the press box. The remainder of the cake is fairly uniform. The fourth test shows a very uniform distribution of oil. This cake was slightly "green" and was fluid enough to permit the equalization of the pressure on the entire surface. Such a test as the one outlined above often aids materially in locating the cause of poor extraction.

While it is true that the cooking of the meats has a direct bearing upon the extraction, the time of cooking, the conditions under which the meats are prepared for cooking, etc., make little difference as long as the meal is cooked to the point where it is not too green to stay in the press yet where the oil is ready to flow. We cannot attempt to discuss here the effect of cooking upon the quality of the oil produced.

We all know that in actual practice it is to our advantage to keep the pressure on the cake for the maximum length of time regardless of the operating cycle. For this reason we try to cut the charging time down to a minimum. Often in doing this the operating parts of the former are speeded up to the point where it no longer turns out uniform cakes. As a result of this we find cakes with high and low spots, thick ends and low centers, wedge shaped cakes and cakes with ragged edges, instead of the level, uniform cake we desired. Such careless forming should be avoided. If speed is necessary keep the former operating at the speeds recommended by the manufacturer and speed up the crew.

In choosing press cloth choose one of the proper width for the press boxes and, if necessary, alter the former tray to fit it. If the cloth is too wide for the former it does not lie flat as the cake is formed and consequently a ragged edged cake results. As for the proper

(*Turn to page 397*)

Hydrogenation Standardizes Quality of Lard*

Stabilization of Packers' Product by Light Treatment with Hydrogen Corrects Shortcomings of Inferior Grades

By M. H. Gwynn and Alan Porter Lee

QUOTING E. G. Montgomery, Chief Foodstuffs Division, U. S. Dept. Commerce in November, 1930 "Food Industries," "an increase of about 10 lbs. per capita in the consumption of vegetable oils is one of the most striking changes in food consumption that has taken place in the past 30 years. Nor has this gain been at the expense of other edible fats. Consumption of butter has declined a small amount but lard consumption has remained practically the same; about 14 lbs. per capita per year during the 30 year period. The average consumption of fats and oils, both vegetable and animal, has reached about 44 lbs. per capita in recent years.

"Vegetable oils, such as olive oil, corn oil and cottonseed oil, were used in a limited way for salad dressings and cooking purposes at the close of the 19th century, but the total consumption at that time was probably not more than about 2 lbs. per capita. With the discovery of methods for hardening vegetable oils, however, new uses were soon found, particularly in the manufacture of shortening compounds and margarines that use vegetable oils as part or all of the raw materials. The principal use is in the shortening compounds, which now amounts to about 8 lbs. per capita."

Certainly a large factor here in the increase of consumption of vegetable fats was the paralleling quality improvement. Note, too, that this increase in the consumption of vegetable oils has until perhaps very recently not affected the consumption of lard in this country. The increase in total fat consumption here is negligible compared to the increase in that of sugar in the last two decades.

Our point is that if saturation in fat consumption has not been reached, (and who would dare say so in view of the extremely important new biologic functions of lipins being daily uncovered) the lard producers have an open field on this continent alone perhaps for their full production, provided that they standardize their quality.

Can improvement of the lower grades of lard be expected from rendering technic? We believe every one will agree that this art has been advanced nearly to its practical limit.

The principal limitations to a more general use of low-grade lard at present are:

1. Its pronounced animal flavor
2. Its lack of adaptability to hot and deep frying arising from its free fatty acid content
3. Its only moderate resistance to rancidity
4. Its softness, giving poor creaming characteristics

We will take up these disadvantages in a little more detail beginning with the flavor.

The decrease in hard manual labor in this country we believe quite a factor in a corresponding decrease of relish of this strong animal taste. The change may or may not be good, but the fact of the change remains.

The smoking point of a fat decreases approximately logarithmically with the fatty acid content which means that the first small increment in a nearly neutral fat is as objectionable as a great increment in a fat of high free fatty acid. Free acid is not the only factor in reducing smoke point, neutral coconut oil (high saponification value) smokes at a comparatively low temperature, as does an ordinary rancid but neutral fat. Free fatty acids have another disadvantage, viz., their pronounced corrosion of iron cooking vessels, rapidly darkening and otherwise damaging the containing fat.

Instability to oxygen in some lards is the resultant of quite a number of well-known factors. The linoleic acid content is generally considerable. A recent article[1] described a fatty acid yielding an octobromide as a nor-

*Presented at Annual Meeting, American Oil Chemists' Society, New Orleans, May, 1931.

[1] Journal Am. Chem. Soc. 152; p. 1135.

mal constituent of lard; viz., more than 0.3%. This is equivalent to 1% of a fish oil. Linseed-meal-fed hogs have been said to yield a linoleic acid in their lard. Again the free fatty acids and the often concurrent metal content which acts as a metallic drier are potent factors in rapid induction of rancidity. These remarks especially apply to the lower grades of lard and ham fats.

Last but not least, much lard is not only too soft for effective creaming but is quite variable in this property. Different feeds, different sections of the country, different portions of the animal produce different consistencies of fat. Large production of course may modulate this disadvantage through extensive mixing.

There is being produced at present more and more ham fat which is unusually soft, i.e., with a titer below 26° C. Some producers have such an excess that they are unable to work this off by mixing in their regular production. The use of the paper carton, too, is precarious with unhardened lard.

The difficulties noted herein have been specifically corrected in practice as follows:

(1) Flavor removal by refining and deodorization.

(2) Free fatty acid removal by neutralization.

(3) Potential and to some extent actual rancidity removal by hydrogenation.

(4) Softness by hydrogenation.

Since refining and deodorization are normal adjuncts to hydrogenation, it is logical to include this latter step if at all economically practicable. By the ordinary powder or batch method, however, this cost, exclusive of hydrogen, approaches that of the refining and deodorizing. By the metal base catalyst or continuous method (the Bolton & Lush Patents) the cost is definitely fractional.

The halving of this hydrogenation cost in the medium size units should not be difficult to understand. By the powder method, it is almost as troublesome to completely harden as to perform a slight hydrogenation. In addition to the cost advantage the absence of kiesulguhr, the very low contact time under heat and reaction (15 minutes) offers a group of important aids to quality.

The free fatty acid decreases rather than increases as in the powder method. The hydrogenation flavor is much less requiring less deodorization with a noticeably less loss. Whereas we have not measured the sterol content before and after a continuous metallic base catalyst hydrogenation, earths including kiesulguhr under the conditions present in batch process hydrogenation have been shown to resinify and adsorb such bodies, which are said to have antioxidant properties.

Below is the average of several analyses on samples we have hardened on a semi-commercial scale, continuously. We were unable to find out how long the catalyst would last without reactivation. At the end of two weeks, the rate of production was still over 90% of the original:

FFA	015%
Iodine Value	55.
Saturated Solid Acids	36%
Solid Unsaturated Acids	2.5%
Liquid Acids	Remainder
I. V. of liquid acids	89
I. V. of the lards before hydrogenation	62 - 64

We wish to point out the unusual degree of selectivity indicated in the low content of solid unsaturated acids. At all but the lowest temperatures, this product was still slightly softer than the present all-hydrogenated cotton seed oil shortenings. If necessary this is correctible by carrying the reaction slightly further.

Summary

HYDROGENATION and its complemental processes not only open new outlets for lard, but offer unusual flexibility of plant processing and handling. The low grade lards have been transformed into products of more utility than the best hitherto produced by the usual methods. The continuous hydrogenation procedure is extremely simple, automatic and as near foolproof as such a chemical process might be. The difficulties of catalyst preparation are completely overcome as well as the necessity for a constant renewal of the supply of catalyst materials.

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A manufacturer of mayonnaise in the South has recently introduced variegated colors for his product, packing it in pink, green and orange tints, for use in decorative effects for salads and sandwiches. There is not yet available a report on the response of the buying public to this innovation, but it seems likely to be favorable.

■

At the first Conference of the new International Society for the Testing of Materials held at Zurich, Switzerland from Sept. 9th to 11th, the second meeting of the International Commission for the Study of Oils and Fats was also held. Among other things, the Commission has undertaken the task of clearing up those doubtful cases where, in the oils and fats trades, unscientific or unauthorized methods of examination are used.

Determination of Unsaponifiable Matter

Considerable difficulty is often experienced and much time wasted in the estimation of unsaponified matter in soaps and unsaponifiable matter in oils owing to the formation of troublesome emulsions. Inaccurate results are frequently obtained due to the lack of a definite separation between the ether and the soap solution layers.

It has been found that a simple treatment of the emulsion formed eliminates these difficulties.

PROCEDURE: Dissolve 5 to 10 grams of soap in 100 cc. of water. In the case of unsaponifiable matter in an oil, saponify the sample by refluxing for several hours with 50 cc. of 0.5 N alcoholic potassium hydroxide, evaporate to dryness and dissolve in 100 cc. of water. Extract the cold soap solution by thoroughly shaking in a separatory funnel with 50 cc. of ether. In many cases a homogeneous emulsion is formed which separates very slowly, if at all.

To avoid this add 3 cc. of alcohol carefully and gently down the sides of the separatory funnel. This is most conveniently handled from a wash bottle. The emulsion will immediately break and complete separation occur within a few minutes. Sometimes it is advantageous to impart a slight whirling motion to the separatory funnel. On no account should the mixture be vigorously or even moderately shaken after addition of the alcohol. Draw off the soap solution layer into another separatory funnel and repeat the process twice more, using 50 cc. portions of ether each time.

Wash the combined ether layers three times with successive amounts of 20 cc. of water. After careful draining and separation of the water evaporate the ether from a weighed flask. Dry for 1 hour at 105° C., or, preferably, in vacuo at 60° C., and weigh.

The above method, if carried out with proper attention to detail, has always given satisfactory results. By its use ether-soap solution emulsions which are difficult to separate by other means are quickly broken, allowing of a rapid and accurate determination of unsaponified and unsaponifiable matter.—FRANK N. BIFFEN in *The Chemist-Analyst*, 20, No. 4, p. 8 (1931).

■

The usual method of determining free alkalinity or acidity in soaps by extraction with alcohol is said to yield erroneous results, as a determination after extracting all free acid with ether still showed 0.5 per cent free fatty acids by the alcohol method. *Chem. Umschau Fette, Oele, Wechse Harze* 38, 110-2 (1931).

Sesame Seed in China and India

Digest of Reports to Bureau of Foreign and Domestic Commerce Covering Culture of this Desirable Oil-bearing Seed*

SESAME seed is produced throughout China from Manchuria to the extreme southern part of the country and as far west as Szechuen. The chief producing area is the Yangtze Valley and the next important region extends from southern Manchuria to Chihli Province. Sesame seed does not constitute the chief crop in any section of the country, but in those localities where a surplus is produced, from 5 to 10 per cent. of the cropped land is devoted to it. It is impossible to give an estimate of the acreage sown with sesamum, nor of the amount produced annually. In Manchuria the crop is only incidental even though a considerable amount of sesame seed is exported through Dairen. In North China, that is, Chihli, Shansi and Jehol, it is estimated that less than 5 per cent. of the cropped land is planted with the seed, and the exports from this area are negligible. Of the Yangtze Valley area, Honan, Hupeh, Anhwei and Kiangsu are the chief producing provinces, wherein from 5 to 10 per cent. of the cropped land is devoted to sesamum.

There are five qualities recognized in export trade, i.e. "white," "black," "yellow," "red," and "mixed." Most of the seed exported is classed as "white," "yellow" or "white and yellow." The black seed is consumed locally. To be classed as "white," the seed must contain less than 25 per cent. dark seed, while if the percentage of dark seed is more than 15 per cent. an allowance must be made in the purchase price. Mixed seed must contain at least 35 per cent. of white seed.

It would probably be easily possible for China to greatly increase the amount of seed produced, but it is not likely that any rapid increase will take place. The Chinese farmer does not react quickly to market demands. His primary object is to produce a sufficient amount of food to fill his own needs and he rarely sows a crop with the idea of marketing it and buying his own necessities. He produces his own necessities and sells his surplus. It is true that the production and exportation of sesame seed on its present scale is due to the fact that it has found a good market abroad and consequently the Chinese farmer has gradually increased the acreage devoted to it. It is also true that the suppression of poppy cultivation was coincident with the increase in sesamum production and probably has been an important factor in this development. There are no arable lands that are not now under cultivation which could be used to increase present production and unless the Chinese farmer has some compelling reason for devoting greater areas to sesamum it is doubtful whether any appreciable increase will take place. If the demand increases, it is probable that the farmers will respond to it, otherwise it seems reasonable to expect that the present production will remain rather constant.

Exports of sesame seed in large quantities began in 1906 as a result of the opening of the Peking-Hankow Railway which opened up the chief sesame seed producing area. Trade in this product was considerably lowered during the World War as European markets, which have always been the largest consumers of this crop, were cut off. In 1919 a very large increase in exports occurred, China's total shipments amounting to 2,838, 500 piculs (one picul equals 133 1/3 pounds). The following table shows total exports for the past seven years:

	Piculs	Value in gold
1923	1,926,000	$9,729,076
1924	934,000	5,265,897
1925	529,000	3,458,852
1926	901,500	5,489,810
1927	656,650	3,277,261
1928	956,160	5,817,929
1929	1,467,208	7,767,803

It is very difficult to determine how much sesame seed was exported during 1930 as reports at present available do not cover the entire year. Exports in general have fallen off and it may be that exports of sesame seed have also been affected by the lack of foreign demand. The chief producing provinces for sesame seed had good crops this past year and it is probable that the quantity exported during 1930 at least equalled the average of the past few years. Sesame seed prices throughout the year were low and declined further during the last quarter. During the early part of 1931

* Published by special permission of U. S. Department of Commerce.

there was a good demand from abroad, especially from the United States for sesame seed and local prices have advanced rapidly. Stocks at Hankow and Shanghai are estimated to be small, but it is understood that there are large quantities of seed yet to be marketed. One of the main reasons for this is that the Hankow-Peking Railway which usually brings this crop to market is now carrying only merchandise that brings high freight rates, thus necessitating that sesame seed be brought in by slower but cheaper methods of transportation.

Hankow has always been the largest shipping point with Shanghai second, these two ports usually accounting for about three-fourths of the total exports. Shasi, Dairen and Kiukiang export almost all of the remainder of China's exports. Exports from these ports in 1929 were as follows:

Port	Piculs
Hankow	603,000
Shanghai	421,000
Shasi	191,000
Dairen	148,000
Kiukiang	104,000

Japan (including Korea) is the largest single consumer of Chinese sesame seed, although the total amount going to European countries is usually greater than that taken by Japan. Holland, Italy, Germany, and Denmark are the chief European importing countries. In 1924 the United States imported 114,000 piculs from China but the next year her imports fell off and were negligible until 1928, when the United States took 50,000 piculs. In 1929 the United States imports of sesame seed from China reached 112,000 piculs. United States imports during 1930 are estimated to be considerably greater. The imports of all of the chief importing countries of Chinese sesame seed have varied considerably in the past few years as is shown by the following table:

Imports of Chinese Sesame Seed

	1923 Piculs	1924 Piculs	1925 Piculs	1926 Piculs	1927 Piculs	1928 Piculs	1929 Piculs
Japan	309,000	254,000	289,000	289,000	310,000	383,000	406,000
Italy	649,000	121,000	77,000	163,000	21,400	131,000	301,000
Holland	253,000	185,000	75,000	158,000	68,000	160,000	342,000
Germany	261,000	131,000	25,000	23,400	17,674	25,310	135,600
Denmark	44,400	42,300	12,000	74,000	33,000	68,000	136,000
France	145,000	13,300	9,000	111,000	40,000	32,600	15,500
United States	63,000	114,000	121,000	18,700	29,000	50,000	112,000

The Chinese Bureau of Commercial and Industrial Information has estimated the average annual production of sesame seed in China, to be about 2,600,000 piculs or something over twice the amount exported. An accurate check of the total production is impossible and the above estimate is probably as accurate as any other. It is only reasonable to assume, inasmuch as Chinese farmers think of their own needs first, that the amount consumed domestically would exceed exports considerably.

The chief use of the seed is for making sesame oil, which is used extensively by the Chinese as a cooking oil. It is generally regarded as superior to other vegetable table oils for this purpose and commands a higher price. The seeds are also used in Chinese confections, and in medicine, especially for poultices. The cake residue after the oil has been removed is used as a fertilizer, and to some extent as a fuel.

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Indian Production and Exports

ALTHOUGH India continues to have more than 5,000,000 acres under sesamum each year, exports of sesame seed have practically ceased. During the year just prior to the war exports aggregated 112,201 tons; but by 1929 the trade had declined to 21,298 tons, and in 1930 total foreign shipments amounted to only 1,235 tons.

Exports of Sesamum Seed from India—9 Months
Tons of 2,240 Lbs.

	1928	Nine Months 1929	1930
United Kingdom	1,117	3,453	—
Netherlands	3,100	2,850	—
France	2,211	535	—
Italy	7,350	1,700	—
Ceylon	770	292	120
Other countries	4,921	1,454	610
Totals	19,469	10,284	730

The decline in exports of sesame seed has not been accompanied by an increase in exports of oil obtained therefrom, foreign shipments of the oil having remained more or less stationary during recent years. During the first nine months of 1930, 113,848 tons of sesame oil were exported, while shipments during the corresponding period of 1929 and 1928 were 124,018 and 127,108 tons respectively.

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A Micro-Kjeldahl Method for Nitrogen Determination*

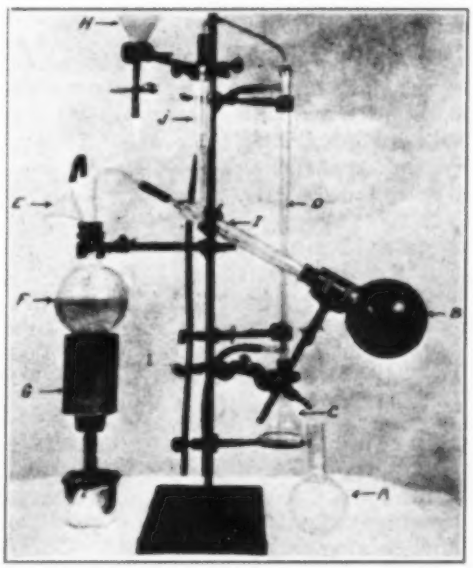
By W. F. ALLEN

THE demand for an accurate, simple, and adaptable method for the micro-determination of nitrogen to be used in connection with caffeine analysis of decaffeinated coffee resulted in the development of the apparatus shown here. It is essentially a micro-Kjeldahl distillation apparatus similar to those of Pregl's, and Parnas and Wagner's[2]. However, it was found to be easier to operate and capable of handling larger samples than the latter. The use of rubber connections was not eliminated, as was accomplished in the apparatus perfected by Kemmerer and Hallett[1], but the apparatus gave very accurate results, and was found to be easily constructed by anyone capable of doing simple glass blowing.

The entire apparatus was made of Pyrex glass. Parts *I* (23.5 cm. long) and *J* (21.0 cm. long) were made from 25 × 200 mm. test tubes. The inside condenser tubing extending over to the top of the safety trap *J* was made of 9-mm. tubing. The condenser is 60 cm. in length.

The method of procedure is as follows: The sample was digested in the 250-cc. Florence flask *A*. This size flask was found capable of handling samples requiring not over 10 cc. of concentrated sulfuric acid in the digestion mixture. With samples containing a large amount of organic matter, it was found to be very convenient to add a few drops of 30 per cent hydrogen peroxide during the last part of the digestion. The cooled digested sample was then diluted with freshly boiled distilled water, care being taken that the flask was not over one-fourth full. The flask was placed in the asbestos-lined jacket *B* and clamped into position as shown. The jacket eliminated the use of a second burner by keeping condensation of steam down to a minimum. However, very satisfactory results were obtained without the use of the jacket by applying heat to flask *A* only during the last 3 or 4 minutes of the distillation.

For samples containing up to 20 mg. of nitrogen, 15 cc. of 4 per cent boric acid[3] and 15 drops of 0.02 per cent methyl red indicator were measured into the 150-cc. evolution flask *C*, which was then placed in position



Apparatus for Micro-Kjeldahl Method

under the condenser *D* with a wide cork resting on top of the flask. Freshly boiled distilled water was next added through funnel *E* into the 500-cc. balloon flask *F* used as a steam generator. Heat was applied to flask *F* by a Bunsen burner *G*, having a shield around the top to prevent air currents from causing variation in the amount of heat applied. Immediately after starting to heat the steam generator, a slight excess of concentrated sodium hydroxide was added through funnel *H* and then washed down with a few cubic centimeters of water. This funnel was immediately closed with a pinch clamp. Distillation was continued at such rate that no bubbling of steam occurred in the receiving flask *C*. After about 125 cc. of liquid had distilled over, in about 12 minutes, the receiving flask was lowered so that the tip of the condenser was about 2 cm. above the surface, and the tip washed down with a small stream of water. Distillation was continued at an increased rate for one minute longer. The pinch clamp on funnel *H* was then released before removing the steam generator to prevent suction. A blank was always

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*Reprinted from Industrial and Engineering Chemistry, Analytical Edition, 3,239-40 (1931).

Notes of the Industry

Mayonnaise Convention

Plans are being completed for the Sixth Annual Convention of the Mayonnaise Manufacturers Association, to be held at the Hotel Stevens, Chicago, October 26 to 28, inclusive. The Board of Directors will meet on the night of Sunday, October 25th, under the chairmanship of W. R. McKeldin, President of the association.

The convention will be featured by addresses and conferences upon selling problems, container simplification, scientific research for improvement of quality, cost determination and other problems of moment to the mayonnaise manufacturers. The entertainment features will include a dinner and theater party and the annual banquet of the association.

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Packaging Exposition in Chicago

At the second Packaging, Packing and Shipping Exposition, scheduled for the Palmer House, Chicago, March 7-12, the story of the packaged and delivered unit from the raw material state of the shipping materials down to the shipments of units of the finished packaged product will be unfolded in a series of exhibits. Among the exhibitors will be: Hinde & Dauch Paper Co., Sandusky, Ohio; Stokes & Smith, Philadelphia; Package Machinery Co., Springfield, Mass., and DuPont Cellophane Co., New York. Exhibits will include practically every type of package and container, including tubes, wrappers, cartons, bottles, paper, folding and set-up boxes, fibre board boxes, glass and moulded containers, mailing boxes, metal-edge folding boxes, outer packages of every variety, air-tight, water-proof and theft-proof packages, packages and wrappers of wood, tin cardboard and cellophane, packaging equipment, machinery and supplies, packing and shipping room equipment and accessories, and transportation and delivery essentials. Among the commodities which will be in various displays in illustration of current methods of packaging, packing and shipping will be toilet articles, soap, bath salts, pharmaceutical and miscellaneous products.

■

During the first six months of 1931 there was exported from Argentina, 1,013,013 tons of linseed as compared with 688,580 tons during the same period of last year. (Report from Commercial Attache Dye, at Buenos.)

Soybeans in Java

The official publication of the Soerabaya Chamber of Commerce, in a recent issue, discusses the prospects of an extensive soybean cultivation in Java. The article states that up to now soybeans had been grown only by natives as a fertilizing cover-crop in the hilly districts of Java and have proved to be of great value. Recently, however, there has appeared renewed interest in their culture on European estates. Soybean culture in Java increased by about 27 per cent during the past fifteen years, namely from 163,000 hectares in 1916 to 208,000 hectares in 1930.

Some change has taken place with regard to the production areas in Java. In West Java, this culture has been maintained at about the same level for the past 10 years. In Mid-Java, however, after a drop in production, there has been a 20 per cent increase while in East Java the culture has been increasing gradually. In 1930, 5 per cent of the cultivation was in West Java, 43 per cent in Mid-Java, and 52 per cent in East Java.

Other pertinent facts include the following: *Java Consumption*, increased 78 per cent in the past 15 years; *Imports* rose in this period from 22,700 tons in 1916 to 18,400 tons in 1930; *Value* of imports in 1930 was about $4,000,000; Soybean *consumption* in Java increased from 2.47 kilos per capita in 1916 to 3.53 kilos per capita in 1920 and to 5.05 in 1930.

Reasons for increasing Java's soybean culture include the demand for foodstuffs from Sumatra, Borneo and other parts of the Outer Possessions; the demand by the Holland dairy industry now being supplied by other countries; and the world demand.

As a measure of aid to the Ceylonese coconut industry, a decree issued by the governor on May 24th suspended payment of export duties on coconut products until further notice.

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Fiji Islands Copra Industry

Tonnage of copra exports during the March quarter showed a drop due to drought damage in 1930 and also to a certain extent to hurricanes experienced in November 1930 and February-March 1931. Total exports during the March quarter of 1931 amounted to only 5,350 tons valued at $315,495 as compared

with 7,385 tons valued at $595,616 in the March quarter of 1930.

Low prices prevailing throughout European markets caused a part of the copra exports to move to San Francisco during the early part of the quarter. Some copra was sold to Mexico and transshipped at the port of San Francisco. When the European markets showed better returns arrangements were made to transship Fijian copra at San Francisco to vessels bound for Europe. Preliminary estimates for 1931 copra production are very low. Some of the exporters estimate total exports for the year 1931 will be above 20,000 tons as compared with exports of 23,882 tons in 1930 and 33,226 tons in 1929. (Report from Consul Roberts at Suva, Fiji Islands.)

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Peanut Oil at Tsingtao

The Tsingtao peanut market was characterized during May, 1931, by heavy demand from Europe and China. Total shipments of peanuts during the month under review amounted to 53,697,600 pounds, which compares with 40,609,500 pounds for the corresponding month last year. The following table shows exports of peanuts from Tsingtao during the present season (November, 1930 to May, 1931) with comparative figures for the 1929-30 season:—

	1929-1930 Season	
	Shelled Pounds	Unshelled Pounds
United States	6,198,000	2,973,500
China	100,650,400	336,000
Japan	16,229,600	6,269,500
Netherlands	41,144,220	3,806,600
Denmark	369,600	—
Germany	61,457,800	2,562,830
United Kingdom	5,470,100	3,595,300
Italy	1,638,400	4,670,200
France	19,513,900	1,431,600
Other countries	4,492,000	2,323,100
Totals	257,164,020	27,968,630

	1930-1931 Season	
	Shelled Pounds	Unshelled Pounds
United States	5,687,900	3,162,500
China	142,370,400	1,274,500
Japan	15,844,500	5,619,500
Netherlands	20,280,000	7,355,400
Denmark	3,684,800	—
Germany	14,406,800	2,848,800
United Kingdom	7,972,200	6,003,400
Italy	5,524,700	5,858,000
France	14,621,700	3,270,400
Other countries	5,025,800	7,637,400
Totals	235,418,800	43,029,900

Exports of peanut oil continued heavy during May and amounted to 13,635,300 pounds, of which the United States acquired 8,700,000, United Kingdom 3,693,800 and China 1,241,500 pounds. Exports of oil during the season of 1930-31 totalled 68,288,300 pounds as compared with 49,053,700 pounds during 1929-30.

Stocks of peanuts on hand at Tsingtao on May 31st, including oil mill stocks and cargo already contracted for, were estimated at shelled, 60,000, unshelled 10,000 short tons. Remaining stocks in the interior available to the Tsingtao market were placed at 20,000 short tons of shelled nuts.

■

The managers of the four lard refining plants in Nuevo Laredo, Mexico, report that business has been alarmingly slow during the past few months. They have been forced, through lack of demand for their products, to curtail operations by 50 per cent, and further reductions will be necessary unless conditions take a sharp turn for the better.

Two of the concerns import all of their raw materials from the United States and both are equipped with American machinery for the making of tin cans which they require. The total capacity of the two plants is 150,000 pounds of pure lard daily but demand has never as yet warranted capacity production. One of these concerns reports that 5,685,679 pounds of lard were refined during the first six months of 1930 as compared with 2,693,643 pounds for the corresponding period of 1931, a decrease of approximately 47.3 per cent. The other plant was not established until November, 1930, and comparative figures for the two years are not available.

■

John Fraser ("Jack") Smith, for more than 37 years with Swift & Company and since 1901 the head of its refinery department, died on September 11 at his home, 6740 Oglesby Avenue, Chicago. He had been ill for many months.

Mr. Smith was one of the best known figures in the refinery business in the United States. He was born November 6, 1863. He came to Chicago from Detroit, entering the employ of Swift & Company in 1894, as a clerk, later becoming a salesman in the lard department. He progressed rapidly and in 1901 was made head of the refinery department, participating in the growth of this department from a small section of the business to one of the important factors. His quiet graciousness of manner won him friends throughout the entire industry. He leaves a widow, Bertha Spaeti Smith. Mr. Smith was a member of the Chicago Athletic Association, the South Shore and Flossmoor Country Clubs.

Robert Gair Co., New York, has established a fellowship at Mellon Institute, Pittsburgh, for research on moistureproofing and greaseproofing paperboards used in cartons.

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Ross Heater & Manufacturing Co., Buffalo, has issued a booklet showing Ross equipment which includes boilers, condensers, expansion joints, exchangers, bleeder heaters, pipe line coolers and vacuum steam jets.

■

The C. O. Bartlett and Snow Company, of Cleveland, Ohio, have recently issued their new Bulletin No. 69, descriptive of their complete line of dryers of all types. Among the various styles of equipment illustrated in this bulletin are to be found direct heat dryers, indirect, and indirect-direct dryers. Each type may be adapted to batch or continuous operation. Particular attention is directed to the Bartlett and Snow Style A steam heat dryer, which is used for drying tankage and similar residual products. This type of equipment is also suitable for drying chemicals and earthy materials of various kinds.

■

Offices of Irving R. Boody & Co., vegetable oil dealers, have been moved from 132 Front Street, New York to 99 Wall Street. The new telephone number is DIgby 4-2051.

■

Durkee Famous Foods, Inc., Long Island City, has announced the removal of its foreign department to 82 Corona Ave., Elmhurst, L. I., N. Y., on September 1st. The new phone number is POmeroy 6-4900. William B. Foster is manager of the foreign department.

■

Harry G. Cowan, district salesmanager for Spencer Kellogg & Sons, Minneapolis, recently completed twenty-five years of service with the company. His associates honored him with the presentation of a suitably engraved watch.

■

Diamond Alkali Co., Pittsburgh, recently began the manufacture of a very pure grade of salt which will run over 99.9 per cent pure sodium chloride and be entirely free of calcium and magnesium compounds.

■

Position Wanted: *Manager*—Sales Manager or General Manager, margarine, compound, salad oils, coconut butters, any edible fats. Address Box M52, *Oil & Fat Industries*, 136 Liberty St., New York.

New Books

BUTTER-FAT (GHEE), *Its Nutritive Value, Adulteration, Detection and Estimation*: By Prof. Dr. N. N. Godbole, and Sadgopal, B.Sc. Privately published at Benares Hindu University. 48 pp.:

The authors have undertaken a discussion of clarified butter-fat (ghee), from the standpoint of protection of the purity of this product which is so popular with the native Indian population. Their monograph is separated into three parts: 1. on the composition, nutritive value and digestibility of the product, 2. a study of previously employed methods of analysis and detection of adulteration, 3. new methods suggested.

The new methods suggested comprise chiefly observation of color fringes whi · are said to appear in the Wollny refractometer during the examination of the clarified butter-fat. The authors assert these color fringes to be characteristic of the adulterating fats, and aver that the amount and kind of adulteration can be determined by the determination of the refractive index, the Reichert-Meissl and Polenske values and the examination of the color fringe in the refractometer. The booklet contains a number of interesting tables of values determined by the authors.—A. P. L.

■

Sesame Seed

(*From page* 390)

The explanation of the decline is exports of sesame seed is to be found in the fact that while production has not increased, consumption in India has been steadily expanding. The oil is used as an illuminant and for anointing the body, but the large use is for cooking purposes. This home demand has placed prices at such a level that it is not advisable to market the seeds abroad in competition with other producing countries.

The final forecast of the 1930-31 crop, which has just been issued by the Government of India, places the total reported area under sesamum at 5,294,000 acres, as against 5,011,000 acres last year. These figures do not cover the entire area planted but it is officially estimated that they include 89 per cent. of the total area under sesamum in India. The total yield of the 1930-31 crop (excluding Hyderabad for which no quantitative estimate of outturn is made at this stage) is estimated at 466,000 tons, as against the corresponding estimate of 390,000 tons for the 1939-30 crop.

Forming Press Cakes

(*From page* 384)

length of cloth, the data given above indicates that the cake must always be completely covered. Economy in press cloth would require that the lap be very small though the amount of lap will depend largely upon the kind of stripper used.

Even after the cake is properly formed it may be ruined by improper panning. The pan shover should never permit any meal to fall from the pan while he is working nor should the cake be mashed or broken as it is slid into the press.

No one can attempt to set a rule for pressing. Ram speeds, time under low pressure, maximum pressure, and drainage time are all factors which depend entirely upon the character of the seed and the market for products. We do know, however, that the press boxes should be in good condition, not bent or distorted, and the drainage channels kept open. The chokers furnished by the manufacturers of the usual change valves are ground to give good uniform action to the ram in the press and the operator need concern himself only with their proper operation.

Remember that uniformity in the press room is one of the principal factors in securing good results. Maintain a uniform operating schedule, permitting the presses to be under pressure as long as possible, speed the crew up so that the presses are charged rapidly without letting the forming of the cake suffer, and watch the hydraulic system so that every pressing receives the maximum pressure on schedule; if these things are followed religiously, good press room work will become the rule.

■

Oil Chemists' Committees

(*From page* 381)

Color Committee: W. D. Hutchins, *Chairman*, Southern Cotton Oil Co., Savannah, Ga., G. W. Agee, E. B. Freyer, G. G. Grant, T. C. Law, C. W. Rice.

SMALLEY Foundation Committee: A. W. Putland, *Chairman*, Armour & Company, Chicago, Ill., G. W. Agee, C. A. Butt, L. B. Forbes, N. C. Hamner, L. C. Haskell, G. K. Wittmer.

Moisture Committee: N. C. Hamner, *Chairman*, Southwestern Laboratories, Dallas, Texas, E. C. Ainslie, C. H. Cox, A. E. King, E. H. Tenent.

Crude Mill Operations Committee: A. K. Schwartz, *Chairman*, South Texas Cotton Oil Co., Houston, Texas, E. C. Ainslie, R. H. Fash, J. J. Ganucheau, J. G. Gibson, J. J. Morris, H. L. Thomas.

Revision of Methods Committee: W. H. Irwin, Swift & Company, Chicago, Ill.

■

Micro-Kjeldahl Method

(*From page* 390)

run using the same reagents and procedure as with the samples, after the apparatus had been thoroughly steamed for at least 15 minutes. Care was taken that the same amount of liquid was contained in each flask to insure the same intensity of color. The contents of the receiving flask *C* from a sample were titrated directly with dilute standard sulfuric acid from a microburet; and the end point was taken when the shade of color of the indicator exactly matched that of the blank. This proved to be a very faint pink at a pH of about 5.7. By matching the blank it was unnecessary to subtract a blank correction from the amount of acid used.

Table I—Comparative Accuracy of Micro-Kjeldahl Method

Samples Analyzed	Nitrogen in Sample	Error with Micro-Kjeldahl	Error with Micro-Kjeldahl
	Mg.	%	%
8	21.114	0.62	0.29
6	1.000		1.20
4	0.583	1.85	0.24
4	0.100		3.00

It can be readily observed that this apparatus and procedure can be used with rapidity and accuracy on samples requiring as much as 10 cc. of cencentrated sulfuric acid in the digestion mixture, as well as samples containing as little as 0.1 mg. of nitrogen. The comparative accuracy of this method with the micro-Kjeldahl method is shown in Table I. By running two sets of apparatus at the same time it was found that 20 samples could easily be analyzed in a half day.

Literature Cited

(1) Kemmerer and Hallett, IND. ENG. CHEM., *19*, 1295 (1927).
(2) Pregl. "Quantitative Organic Microanalysis," pp. 94—104, Blakiston, 1924.
(3) Scales and Harrison, J. IND. ENG. CHEM., *12*, 350 (1920).

■

Position Wanted: *Chemist*—Has recently developed a new process for decolorizing and bleaching beeswax, also applicable to some oils and fats; desires permanent position. Address Box No. D71, *Oil & Fat Industries*, 136 Liberty Street, New York City.

Oil Chemists' Fall Meeting at Chicago October 29, 30

HELD the second year in succession at the Congress Hotel, Chicago, on October 29 and 30, the Annual Fall Meeting of the American Oil Chemists' Society, again surpassed all previous records for attendance at the sessions, number and enthusiasm of attendance, volume and standard of scientific and technical papers presented. The meetings were held in the Florentine Room of the hotel, which provided ample space for the attendance, as well as for the numerous exhibits of apparatus, equipment and supplies which were placed on display by manufacturers and supply houses.

A. S. Richardson
President
A. O. C. S.

Archibald Campbell
Vice-President
A. O. C. S.

The first day's session was presided over by Archibald Campbell, Vice-president and *Chairman* of the Soap Section, and was devoted chiefly to papers and committee reports having particular application to the chemistry and technology of soap, detergents and allied products. The meeting was opened by W. H. Irwin, *Chairman* of the Chicago Committee on Arrangements, who introduced Colonel Gaw, personal representative of Mayor Andrew J. Cermak of Chicago. Colonel Gaw delivered a warm address of welcome to the visiting delegates on behalf of the Mayor and City of Chicago. At the conclusion of Colonel Gaw's talk, President A. R. Richardson took the Chair, for a few words of welcome and appreciation to the visiting members and guests, after which the conduct of the meeting was relinquished to Vice-president Campbell.

The first business of the day consisted of the submission of reports by the chairmen of committees on Detergents, Glycerin Analysis and Soap Analysis. The report of the Glycerin Analysis Committee, submitted by M. L. Sheely on behalf of J. T. R. Andrews, *Chairman*, consisted of a brief progress report only. Complete reports were submitted by J. G. Vail, *Chairman* of the Detergents Committee and M. L. Sheely, *Chairman* of the Soap Analysis Committee.

AFTER reception of the committee reports, the meeting turned with interest to the presentation of the day's scientific and technical papers. The papers presented included the following:

1. "Soap Phases," R. H. Ferguson, Procter & Gamble Co., Ivorydale, Ohio.

2. "Light Colored Saponified Fatty Acids," R. B. Trusler, Davies-Young Soap Company, Dayton, Ohio.

3. "Notes on Power Laundry Practice," C. E. Lennox, Swift & Company, Chicago, Ill.

4. "Studies in the Comparison of Detergents," W. H. Burkhart, Gold Dust Corporation.

5. "The Determination of Water in Soaps," A. K. Church, Lever Brothers Company.

6. "Activated Carbons, Their Production and Uses," J. Wrench, Industrial Chemical Sales, New York City.

7. "A New Method of Rendering," O. H. Wurster, Wurster-Sanger Company, Chicago, Ill.

At the conclusion of the first day's session, an informal luncheon was held in the Pine Room of the Congress Hotel. More than one hundred of those attending the sessions of the meeting were present at the luncheon, which

was devoid of formal speechmaking, being devoted to renewal of acquaintances and informal conversation. This feature of the first day was repeated on the second day of the meeting.

After luncheon on the first day, a large party of members and guests journeyed by motor to Hammond, Indiana, at the invitation of Lever Brothers Company, to inspect that corporation's new $5,000,000. soap factory in that city. There those in the party had the privilege of viewing what is undoubtedly the most modern soap manufacturing establishment in this country, if not in the entire world. The plant is housed in several buildings of cream-colored brick, erected facing a beautifully-kept lawn, the entire property being surrounded by a wrought-iron fence, with entrance gateways in harmony with the building design.

W. H. Irwin, Chairman Chicago Meeting Committee

THE visitors were conducted by specially appointed guides through the office, warehouses, steam boiler plant, oil refinery, water treatment and filtration plant, soap-kettle room, oil storage warehouse, soap drying department, flake soap packaging room and the chemical laboratory. Every feature of the plant has been designed with a view to economy and efficiency of operation. One of the most notable features was observed in the design of piping throughout the works in such manner that headroom and accessibility are nowhere impaired. The soap-kettle room in particular presented a most attractive appearance, the walls being finished in architects' tile of a soft buff color, and all overhead space being clear of piping of any sort.

Another particularly interesting feature of the plant is the use of air-conditioning equipment throughout the manufacturing departments, for the preservation of uniform temperatures and relative humidities regardless of weather conditions. The effect of the air-conditioning apparatus was most notable in the soap-boiling department, which, despite the absence of kettle-hoods was peculiarly free of the clouds of steam usually encountered in such locations. At the conclusion of the visit, each member and guest was presented with a souvenir box of soaps and toilet articles, with the compliments of Lever Brothers Company.

The second session of the meeting convened at 10:00 A.M. on Friday, October 30, with President Richardson in the chair. This day of the meeting marked the presentation of papers particularly relevant to the processing of edible oils and fats. The papers offered included the following:

1. "Changes in Edible Oils and Fats due to Atmospheric Oxidation," H. Aspegren, Norfolk Research Corporation, Norfolk, Va. (Read by title only.)

2. "A Process for Refining and Deodorizing Oils," V. Conquest, Armour & Company, Chicago, Ill.

3. "Oils and Fats as Food for Mammals and Micro-organisms," L. B. Jensen, Swift & Company, Chicago, Ill.

4. "Some Observations on Oil Refining in Europe," R. W. Perry, William Davies Co., Chicago, Ill.

5. "Feed Control and Some Recent Developments," H. A. Halvorson, Minnesota State Department of Agriculture, St. Paul, Minn.

6. "The Significance of the Recent Rapid Growth in Whale Oil Production," R. W. Harrison, Bureau of Fisheries, Gloucester, Mass.

7. "The Technology of Whale Oil," A. P. Lee, MacNair-Dorland Co., New York, and H. P. Trevithick, Bureau of Chemistry, New York.

8. "Commercial Aspects of the Uses of Sunflower Seed Oil, Sesame Oil, and Soya Bean Oil," G. G. Fox, Armour & Company, Chicago.

9. "Mayonnaise Oils, Mayonnaise, and the Kreis Test," A. G. Olson, General Foods Corporation, and C. A. Southwick, Jr., General Foods Corporation.

10. Peroxide Formation as a Measure of the Autoxidative Deterioration of Vegetable Oils," D. H. Wheeler, Mayonnaise Manufacturers Association.

AT the Friday morning session, President Richardson introduced Professor E. N. Gathercoal, of the Department of Pharmacy, University of Illinois, President of the recently-organized Inter-Society Color Council.

In the course of well-chosen extemporaneous remarks, Professor Gathercoal described the sequence of events and conditions, (starting in 1922 with the efforts of the U. S. Pharmacopoeia Revision Committee), which have culminated in the organization of the Inter-Society Color Council. Professor Gathercoal also outlined some of the aims and purposes of the Council, and expressed his appreciation

of the participation of the American Oil Chemists' Society in the organization of the new scientific body.

Mr. G. S. Fawcett, Managing Director of Tintometer, Ltd., was introduced by President Richardson, and made a brief talk, in which he assured all present that the firm of Tintometer, Ltd., is anxious to cooperate to the fullest extent with the American Oil Chemists' Society and the Bureau of Standards in the work of standardizing Lovibond color slides and eliminating all of the causes of dissatisfaction with the tintometer glasses and instruments which have arisen in the past. Mr. Fawcett's sincerity impressed the members favorably and a cordial reception was accorded him.

At the conclusion of Friday's session, which had been prolonged after a luncheon intermission, because of the number of papers and addresses presented, the Meeting adjourned, with, at the suggestion of President Richardson, a rising vote of thanks to the Chicago Local Committee, the Ladies' Committee, the exhibitors, the management of the Congress Hotel and all others who had contributed so much of their time and effort to make the Fifth Fall Meeting of the American Oil Chemists' Society the outstanding success which all agreed it to have been.

On Friday afternoon, personally conducted visits to the various manufacturing plants of the Chicago district, particularly the stockyards plants, were open to those who could avail themselves of the opportunity. There was also a meeting of the governing committee of the Society at this time. A visit for members and guests, including ladies, to the Chicago Planetarium on Friday night completed the entertainment program of the meeting.

The entertainment especially provided for ladies included the visit to the Lever Brothers Company plant for all who desired to make the trip, and a bridge luncheon on Friday afternoon, October 30. While the number of ladies attending the convention from points outside of Chicago was small, those who were present reported a visit of much enjoyment.

Exhibits

THE exhibits displayed in the Florentine room, where the sessions of the Meeting were held, attracted much favorable notice from those attending. Included among the exhibitors were:

Central Scientific Co., Chicago; Wilson & Bennett Mfg. Co., Chicago; The Skelly Oil Co., Chicago; American Allied Aetna Carbon Co., Columbus, O.; Fred S. Carver, New York City; The Emil Greiner Co., New York City; A. Daigger & Co., Chicago; W. M. Welch Co., Chicago; Industrial Chemical Sales Co., Inc., New York; The Laboratory Construction Co., Kansas City; E. H. Sargent & Co., Chicago; Merck & Co., Rahway, N. J.; Precision Scientific Co., Chicago; Purina Mills, St. Louis, Mo.; Kewaunee Mfg. Co., Chicago.

The Central Scientific Company exhibited laboratory apparatus, much of it of their original design, including moisture ovens and Kjeldahl apparatus.

Wilson & Bennett Mfg. Co. displayed steel shipping containers of many varieties.

The Skelly Oil Co. showed samples of special petroleum solvents for fats and oils.

Fred S. Carver exhibited the Carver laboratory hydraulic press, equipped with specially designed apparatus for obtaining sample of pressed oil for laboratory determination of the percentage of free fatty acid in seeds.

The Emil Greiner Co., laboratory apparatus and glassware.

Industrial Chemical Sales Co. displayed products bleached with Nuchar and Suchar, activated carbons.

Merck & Co. exhibited Merck Chemicals, of standard laboratory, chemically pure and analyzed qualities.

Kewaunee Mfg. Co. exhibited furniture for chemical laboratories and fume-hoods.

Purina Mills, manufacturers of soy bean oil, created much interest in their exhibit, which was labeled "Sardines swimming in Purina soy bean oil," and which many visitors suspected of being gold fish swimming in a bowl of artificially colored glass. At any rate, the exhibit was successful in directing attention to Purina Mills as newcomers in the field of soy bean oil production.

Laboratory Construction Co. displayed their exceptionally well-designed line of Kjeldahl apparatus, distillation apparatus and electric heaters.

American Allied Active Carbon Company displayed their activated carbons for decolorizing oils and fats.

Other interesting displays of laboratory apparatus, glassware and chemicals were presented by *E. H. Sargent & Co., Precision Scientific Co., A. Daigger & Co.*, and *W. M. Welch Co.*, all of Chicago.

Bowling Tournament

THE outstanding entertainment feature of the Meeting was the annual bowling tournament, which was held at the Bensinger Alleys,

A. O. C. S. Bowling Challenge Trophy

235 South Wabash Avenue. This tournament brought out more contestants than any previously held by the Society. There were ten 5-man teams, eight 2-man teams and several individual bowlers entered into the competition. Some very fine scores were recorded.

The Nuchar Challenge Trophy Cup was won by the Amaizo team of the American Maize Products Company of Roby, Indiana. This is the second year in succession that the challenge trophy has been won by the Amaizos, giving them a second leg on the cup, which will become their permanent possession if they succeed in winning it just once more, without an intervening win by some other team.

The high single game prize was won by the Swift Vream team, headed by W. H. Irwin, *Chairman* of the Chicago Meeting Arrangements Committee. President Richardson was also member of a prize-winning team, his Procter and Gambles from Ivorydale annexing second team prize. Third team prize went to the Swift Premiums and fourth to the Swift Vreams, both of Chicago.

FIRST 2-man team prize went to Meyers and Boskovitz of American Maize Products Company, second to Uhle and Ruby of Swift and Co., Chicago. M. Dugan of Swift and Co., Chicago, distinguished himself by annexing the surprise handicap prize as well as the high single game prize. The individual 3 game high-score prize was tied for in a dead heat between C. A. Renhart of Swift & Co., and W. Meyer of American Maize Products Co. It is apparent that some of the members will have to brush up on their home alleys in order to break up this apparent Swift-Amaizo monopoly of prizes. The tournament was ably managed by John P. Harris, of Nuchar fame, assisted by W. H. Irwin and members of the Swift and Company laboratory office staff.

The Chicago Local Committee in charge of the Meeting consisted of W. H. Irwin, *Chairman*, J. P. Harris, J. J. Vollertsen, A. W. Putland, L. M. Tolman, M. L. Sheely, and A. E. King.

IN ADDITION to a considerable number of visitors who attended the sessions of the meeting but did not register, the following is a full list of registrants:

A. W. Putland, E. J. Bennett, F. E. Joyce, R. B. Trusler, E. R. Luckow, R. W. Perry, B. R. Harris, L. M. Tolman, G. Ormsby, G. S. Fawcett, R. H. Ferguson, J. L. Schille, M. E. Grien, J. W. Bodman, E. A. Sigworth, C. B. Cluff, Archibald Campbell, Ira P. McNair, L. M. Gill, M. L. Degavre, A. S. Richardson, P. Goldfisch, M. M. Durkee, A. R. Pye, J. G. Vail, D. M. Gray, H. A. Halvorsen, A. K. Church, L. B. Kilgore, E. N. Gathercoal, F. S. Carver, J. Wrench, L. M. Kishlar, V. Serbell, W. E. Oyler, J. Lappen, P. L. Stern, R. C. Hatter, W. H. Burkhart, W. J. Reese, A. P. Lee, L. M. Roeg, A. G. Olsen, J. M. Olinger, G. A. Moore, R. V. Lenox, H. J. Cary-Curr, H. Sieck, R. W. Jaeger, Jr., H. C. Cooper, A. A. Robinson, H. C. Dormitzer, A. K. Epstein, O. H. Wurster, V. Conquest, R. W. Schnieder, F. A. Steinko, L. B. Jensen, R. E. Kistler, E. C. Seamon, C. E. Lennox, R. H. Potts, T. H. Petersen, Elmore Davies, W. L. Taylor, J. S. Boros, H. S. Mitchell, M. L. Hartley, A. E. MacGee, R. E. Blake, W. W. Pitam, B. J. Olsen, W. G. Lowry, D. P. Grettie, R. A. Phair, G. D. Wiles, A. Guillaudeu, R. E. Barry, F. E. Dodge, R. P. Lutz, D. L. Weatherhead, C. B. Clark, C. Forester, H. J. Hlovka, N. C. Eiselie, L. E. Young, L. F. Hoyt, B. Morey, R. P. Hereds, R. C. Newton, T. A. Gieralin, F. E. Fischer, C. E. Shoms, R. W. Harrison, Arthur Schroeder, A. D. Ralston, S. V. Schnabel, F. C. Vibrans, G. G. Grant, M. A. Beck, W. P. Hilliker, Ralph Wechsler, Harry M. Wylely, R. E. Wright, E. A. Siegal, Geo. W. Trainor, N. A. Bayer, Frank C. Haas, A. S. Richer, R. J. Short, C. E. Morris, C. W. Christensen, John E. Tarman, F. Micko, J. J. Vollertsen, M. L. Sheely, A. E. King, J. P. Harris, W. H. Irwin. LADIES: Mrs. S. G. Ormsby, Mrs. M. L. Sheely, Mrs. J. J. Vollertsen, Mrs. W. H. Irwin, Mrs. M. M. Durkee, Mrs. B. R. Harris, Mrs. R. W. Perry, Mrs. E. R. Luckow, Mrs. R. B. Trusler, Mrs. F. E. Joyce, Mrs. E. J. Bennett, Mrs. A. W. Putland, Mrs. L. M. Tolman, Sr., Mrs. L. M. Tolman, Jr., Miss Beth Vollertsen, Mrs. J. P. Harris, Mrs. Dexter, Mrs. McCarthy.

Mayonnaise Spoilage and Rancidity of Oil

Many Factors Exert Influence Upon Keeping Qualities of Mayonnaise, Thousand Island Dressing and Sandwich Spreads

By A. S. RICHARDSON, E. W. ECKEY and J. T. R. ANDREWS

The Procter & Gamble Company, Ivorydale, Ohio

IN ITS broadest sense, the term "rancid" is applied to almost any material which has developed an offensive smell or taste. We hear of rancid nuts, rancid cheese, rancid butter, rancid bread, rancid candy and we oil chemists hear most of all about rancid oil.

We are inclined to appropriate the word rancidity and think of it as applying primarily to fatty materials. We have even begun to influence popular dictionaries, one of which gives as the preferred definition of rancid: "Having the peculiar smell of oily substances which have begun to spoil." Certainly among ourselves, we oil chemists must think of the word rancidity as applying principally to a certain disagreeable odor and flavor which no one can exactly describe, but which we recognize as one of the results of oxidation of fatty material. In the world at large rancidity is quite another matter; it has long been used and will long continue in use as a general term for offensive taste and smell, regardless of any effort to restrict its meaning.

Even as a technical term in oil chemistry, rancidity must not be too narrowly defined. Each oil presents a separate set of complications. The free fatty acids of butter have a foul odor and may be the sole cause of rancidity in butter fat, whereas cottonseed and most other free fatty acids are odorless and almost tasteless, and have no direct connection with the practical problems of rancidity. The peculiar odor resulting from the oxidation of fish oils is qualitatively different from the odor of oxidized drying oil of vegetable origin, which in turn is different from the odor of oxidized semi-drying or non-drying fatty oils or animal fat. Aside from differences in the nature of the true fatty matter which may be oxidized, each oil has its own peculiar set of non-fatty constituents, small in amount, but sometimes having a powerful effect on the odor of the oxidized oil.

Rancidity Problems of Interest to the Mayonnaise Manufacturer

WHAT aspects of this broad and complicated problem of rancidity of oil are of special interest to the mayonnaise manufacturer? Obviously the mayonnaise manufacturer is directly interested in the rancidity of salad oils only, consisting chiefly of corn oil and winterized cottonseed oil in the United States up to the present time. The interest of the mayonnaise manufacturer is, or should be, confined to the type of oil rancidity which results from oxidation. However, rancidity is by no means synonymous with oxidation, or related to it in any simple manner.

Above everything, the mayonnaise manufacturer should know to what extent rancidity of oil contributes to deterioration and spoilage of mayonnaise. In this connection, a useful point of view will be to consider separately (1) rancidity of salad oil resulting from oxidation up to the time of mixing and packing mayonnaise and (2) history of the oil thereafter.

Development of Rancidity in Oil Before Incorporation in Mayonnaise

OXIDATION of oil doubtlessly occurs to some extent even in oil-bearing seed before crushing. Unpublished data available to the authors suggest that, within practical limits, this is of negligible importance in the case of cottonseed salad oil. Oils believed to be from seed exposed to varying degrees of oxidation were refined and deodorized, and found to show no significant difference in rate of development of rancidity. Further study of this difficult problem may some day yield interesting results.

Oil is next exposed to oxidation as crude oil. Both corn oil and cottonseed oil, in their crude state, show wide variations in their suscepti-

bility, over the same general range, as shown in figure 1. Each curve here gives the result of an experiment in which one gram of oil was exposed to air in a 50 cc. Erlenmeyer flask at 120° F and the course of oxidation followed by means of a mercury manometer. The majority of samples of both these crude oils should be classed as showing relatively high resistance to oxidation. After alkali refining, susceptibility to oxidation is greatly increased and becomes of more practical interest to the mayonnaise manufacturer. At least from this point, all oxidation is injurious to flavors, even if the oil does not become distinctly rancid.

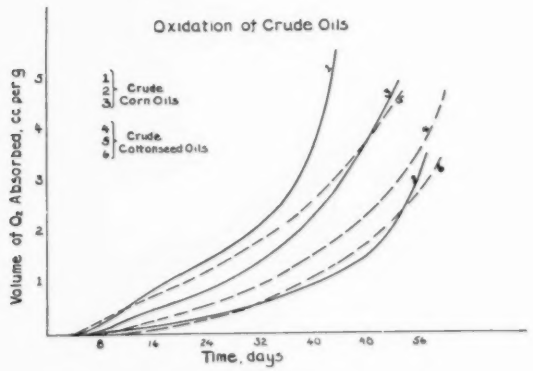

Fig. 1

Winterizing involves very little possibility of oxidation, because of the low temperature at which it is carried out. Steam deodorization, the final essential step in the processing of the edible oil, partially compensates for any previous oxidation, but cannot give neutral flavor to a rancid oil. Neither of these processing steps has any very great effect on susceptibility of oil to oxidation, but careful handling naturally involves less oxidation and gives a better flavor than careless handling.

Different samples of both cottonseed and corn oils, after complete processing as salad oils, will vary in susceptibility to oxidation, again over the same general range. Oxidation curves on the finished oils are similar to those shown in figure 1, except that differences are somewhat less and the average rate of oxidation about five times as fast. Our observations in this respect contradict the statement of Harris and Epstein (The Canner, Dec. 6, 1930, p. 28) that "corn oil is markedly more resistant to attack by oxygen than an oil like cottonseed." We find no consistent drift in favor of either oil as measured by oxygen absorption tests, but do note a less rapid development of objectionable flavor in cottonseed oil under similar conditions of exposure to air. Possibly the conclusion of Harris and Epstein was based on too limited a number of experiments. We have on record individual sets of experiments which would prove (?) either oil the more susceptible to oxygen absorption.

Thus up to the point of complete processing of a salad oil, the mayonnaise manufacturer is vitally interested in the problem of oil rancidity. The manufacturer of the salad oil can offer no satisfactory alibi for either a rancid oil or one which is off in flavor as a result of oxidation. The ideal salad oil is an unoxidized oil.

Behavior of the Oil After Incorporation in Mayonnaise

IS there not further great danger from this thing called incipient rancidity? Even though oil of good flavor is put into mayonnaise, does it not later turn rancid and become a major factor in mayonnaise spoilage? The proper answer to this question is an emphatic "no". Incipient rancidity is bad enough from the standpoint of its effect on flavor of oil as incorporated in mayonnaise; to saddle upon it the burden of blame as a major source of mayonnaise spoilage thereafter is without justification in theory or fact. In plain language, the mayonnaise trade has been the victim of mistaken emphasis on the subject, emanating from so many sources that none need be named.

As already mentioned, development of rancidity in salad oil requires oxidation, or, in other words, requires air. Mayonnaise is packed in an almost tight container. Even if the mayonnaise jar contained 20% air, the amount of oxygen furnished thereby (less than 0.01% of the weight of the oil) would be insufficient to make a critical difference in the flavor of the oil. To be sure, further exposure occurs when the jar is opened, but the mayonnaise is usually consumed rapidly or afforded the protection of an ice box or other cool place. There is another factor which, practically speaking, keeps rancidity of oil in mayonnaise from becoming a major factor in spoilage. Even assuming free exposure to air at ordinary atmosphereic temperature, evaporation of water will spoil the appearance of the mayonnaise surface before the oil turns rancid. Of course, oil may get the blame, especially since free oil will probably separate, but oil would still be likely to get the blame even if it were inherently and absolutely unoxidizable.

We have been assuming above that, if mayonnaise is oxidized the oil will take up the oxygen. Even this assumption will not stand critical examination. Egg is rich in material

which takes up oxygen more readily than oil. At least two of these substances are known to act specifically as antioxygens, giving a substantial protection against oil rancidity. Harris and Epstein have presented observations on this subject, mentioning cholesterol as the probable inhibitor of oxidation. The full facts have not been developed, but lecithin is in general a still more powerful antioxygen, and is present in egg yolk in still larger amount (about 9%!) than cholesterol.

We do not question the possibility of oxidation of oil in mayonnaise to the extent that might be recognized by some deterioration in oil flavor, if the other ingredients of the mayonnaise were not present to obscure the effect. We merely assert that the condition of oil after incorporation in mayonnaise is such that it is extremely unlikely to go rancid, and that rancidity of present day salad oils is not a major factor in mayonnaise spoilage. We have at various times examined hundreds of samples of mayonnaise in various stages of deterioration, including many dozens of samples which had to be regarded as inedible. In a negligible number of such samples was there ever any suggestion of oil rancidity.

Why, then, does mayonnaise go rancid? In the special sense of oil rancidity, it rarely does. In the broader sense, it does go rancid, and for the explanation we should look to the organic constituents other than oil. The egg is the most perishable material; vinegar and sugar not above suspicion; and even the spices are subject to decomposition when wet.

In view of its composition, spoilage of mayonnaise is remarkably slow. A tight container, sufficient in itself to protect the oil, is no insurance at all against decomposition of egg. The latter, unmixed with other materials, would undergo bacterial decomposition and spoil within a few days, whereas a typical good mayonnaise is likely to remain quite fresh for weeks and edible for months. As is well recognized, some of the other ingredients in the mayonnaise must protect the egg from its usual rapid spoilage.

We have investigated the usual ingredients separately and in all possible combinations, and find the triple combination of salt, vinegar, and a little mustard oil a remarkably effective, but not perfect, egg preservative. Probably the oil has considerable additional preservative effect, although alone it would be ineffective. Thanks to the combined preservative effect of these ingredients, the bacteria normally present in egg are killed or suppressed to the point that commercial mayonnaise ordinarily spoils very slowly. However, mayonnaise has been known to spoil rapidly, becoming practically inedible within as short a time as two or three weeks. This is not the normal behavior, but has occurred not infrequently in the past. This rapid spoilage used to be very mysterious. We have fairly well emerged from darkness to light, with remarkably little frank and open discussion of the important factors involved.

Let us go back about six years. A number of people were making good mayonnaise, including several large producers. In one way or another they knew the secret of avoiding rapid spoilage, but naturally enough they were not telling all they knew. There were learned (?) dissertations and speeches on mayonnaise spoilage. Troubles were classified, for instance, as physical and chemical, and these further classified into subdivisions. The result was usually a catalogue of the causes of mayonnaise spoilage, more or less truthful, but not very useful on the particular subject of rapid development of rank flavor.

About five years ago we started out in our laboratories to find which ingredients in mayonnaise were chiefly responsible for rapid development of bad flavor. The results were striking; mustard alone presented a serious problem. The other ingredients from almost any source made mayonnaise that kept well, but of commercial brands of mustard flour tested at that time only two appeared safe, as compared with a much larger number which introduced a fatal contamination, presumably bacterial in nature. We have not reinvestigated the matter, but understand that the situation is now greatly improved. The matter of contamination through the spices has been gradually dragged into the open, with rather less emphasis than it deserves. Possibly we put undue emphasis on the mustard; if so, let others offer their evidence.

Mariam S. Iszard was one of the first to focus attention on the spices. (Canning Age, *8*, 434 [1927]). Dr. Iszard isolated specific bacteria associated with spoilage of salad dressing, and attributed the contamination to "a heavily spiced foundation paste." She did not study the spices separately. Gray, discussing bacterial spoilage in mayonnaise relishes and spreads, suggested the sterilization of the separate ingredients, and called particular attention to a bacterial spore in pimentos, resistant to heat. (The Canner, Aug. 6, 1927, p. 31.) Pederson, studying bacterial spoilage of thousand island dressing, found contaminating organisms in pepper and paprika. (The Spice Mill, *54*, 405 [1931].) Doubtlessly this list of references could be extended further.

When mayonnaise is diluted or mixed with other ingredients to make sandwich spreads, thousand island dressing, and other specialties, the chances of bacterial spoilage are greatly increased. In such preparations, mustard contamination is only one possibility to be emphasized. But when mayonnaise proper deteriorates so rapidly as to become inedible within a few weeks, it is time to examine the mustard very critically. Mustard oil is free of this contamination and may serve as a useful check against suspected mustard flour, even though the latter may be preferred for regular use.

Summary

SUMMING up, we believe that the mayonnaise manufacturer is vitally concerned with oil rancidity, but that the whole of his real interest relates to the problem of getting an oil of good flavor into the mayonnaise. Thereafter, development of rancidity in present day salad oils is so slow that it is practically never a critical cause of mayonnaise spoilage.

The oil in mayonnaise is normally well protected against appreciable oxidation by antioxygens in the egg and by a closed container. If it is freely exposed, the mayonnaise is spoiled by surface evaporation of water before the oil has time to become rancid.

The important cause of mayonnaise spoilage, other than mechanical separation, is bacterial decomposition. Decomposition due to organisms from the egg is fairly well checked by the preservative action of salt, acetic acid, and mustard oil. Resistant organisms capable of causing rapid spoilage of mayonnaise are most likely to be introduced through mustard flour. Some mustard flours are suitable and some unsuitable for mayonnaise.

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Glycerin Analysis Committee Report

The Glycerin Analysis Committee will continue the investigation begun last year of the discrepancy between the acetin and other methods of glycerin analysis. We propose to determine first the cause of the low results by the acetin method and, once the cause is known, we hope to find a remedy for it, if possible.

The membership of the Committee will remain essentially the same as last year.

J. T. R. ANDREWS, *Chairman*

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Comparative determination of free fatty acids in fats showed that as accurate results are obtained by use of a solution of alkali in alcohol as by the use of a mixture of alcohol-ether or alcohol-benzene, provided the titration is carried out at high temperature when ether or benzene is not used. Moreover, the use of ether has the disadvantages that the dissolved neutral fat is very easily saponified (this makes the endpoint more difficult to detect) and that commercial ether frequently contains esters which are saponified at low temperature and are, therefore, counted as acidity of the fat, (this necessitates preliminary distillation of the ether over sodium). No difference was noted when aqueous or alcoholic potassium hydroxide solution was used. *Chimie et Industrie,* Special No. 637 (March, 1931).

■

A hydroxy-polybasic aliphatic acid compound such as a tartrate may be added to compositions such as those containing castor oil and nitrocellulose in order to retard rancidification. U. S. Pat. No. 1,805,458.

■

The rate of expansion of fats on heating, starting with solid fat at 20° C., has been investigated with the aid of a specially designed dilatometer. A myristo-laurin mixture expands during melting at 35°, 8,500 cubic millimeters per 100 grams; fully hardened linseed oil (almost pure stearin) expands up to 39°, then contracts from 39 to 47° to even below its original volume, then expands again and at 64-69° the volume increase is 16,900 cu. mm. per 100 g. Oleic acid shows a fairly uniform expansion rate without sudden increase at any one temperature, but slight irregularities appear when the rate of freezing is varied. More or less irregular curves are shown for tallow, butter fat, compound lard, hardened soybean oil and hardened peanut and fish oils. *Chem. Umschau Fette, Oele, Wachse Harze* 38, 17-22 (1931).

■

Mrs. M. F. Lauro, wife of Michael F. Lauro, Assistant Chemist, Bureau of Chemistry, New York Produce Exchange, passed away at Liberty, New York, on November 10th. She was survived by her husband and two children. Mr. Lauro has been a frequent contributor to the scientific literature of the American Oil Chemists' Society and has been *Chairman* of the Olive Oil Committee for the past two years. The sympathy of his many friends in the Society is extended him in his loss.

■

POSITION WANTED: By refiner of corn oil. Thoroughly familiar with refining, bleaching, deodorizing operations. Capable supervising refinery. Do own analytical work. Understand structural layout equipment. Address Box F19, care *Oil & Fat Industries,* 136 Liberty Street, New York, N. Y.

Detergents Committee Report to Oil Chemists' Society

Standardization of Procedure in Washing Tests Will Promote Obtaining Comparable Results in Different Laboratories

By JAMES G. VAIL, *Chairman**
Philadelphia Quartz Company, Philadelphia

FURTHER work directed toward the development of a test of detergency leads the committee to believe that the task committed to its care has been advanced. It has also necessitated reconsideration of the objectives and the limitations which necessarily surround the problem. It is believed that no single test can be devised to measure detergent action under all the manifold conditions of practical cleansing. It is in the nature of the case impossible. If, however, a tool can be provided which will enable different laboratories to obtain concordant results, a new means of advancing the knowledge of detergents will be available. This appears worth doing and preliminary results indicate that it is possible. The present report is presented in the spirit of offering a proposal useful for study, rather than a standardized test from which exact quantitative checks are for the present to be expected.

In considering any test of detergency it is important that the scope of its usefulness should be understood. Washing is a complicated process dealing with many surfaces to be cleaned and many kinds of dirt to be removed. Both fabric and dirt differ chemically and physically and these differences affect profoundly the amount and kind of washing necessary to achieve the desired degree of cleanliness. Changes of temperature, concentration and composition of detergent solutions, the kind and degree of mechanical action, are all dictated by peculiarities of materials to be cleansed and will affect the choice of detergents. No one detergent is best for all kinds of work. Any test which indicates otherwise is false and misleading. Comparisons may nevertheless be made under conditions appropriate to the work in hand and a technique common to many workers may enable them to compare and coordinate their experiences.

In the attempt to reduce variables to a minimum, one type of pigment, one soiling method, and one type of fabric have been selected. The mechanical conditions, which are known to be important, have been arbitrarily standardized and cleanliness has been judged by the measured reflection of light from the fabric. If these conditions have yielded a procedure which will enable different workers to obtain the same results, a tool not hitherto available has been provided. It does not follow that all the important characteristics of detergents may thus be appraised. We would emphasize that the method must be used with discrimination.

It seems likely that a dark colored pigment will yield results more directly comparable to the miscellaneous dirt encountered in practice than any other simple soil. Carbon black is more difficult to remove from cotton fabric than most other types of dirt. Utica sheeting has been chosen as a readily available and well standardized cotton fabric and an extracted carbon black from one manufacturer has been used. Apparently different lots of this grade yield the same results and it may be that other grades of extracted lamp black can also be employed, but it should not be assumed without proof that carbon blacks generally are suited for the test.

WE MAY tentatively accept as a working hypothesis that such soil constituents as fats and oils, starches and albuminous materials which have not been coagulated will be removed before the fabric is free of carbon black. Carbon black offers the advantage of convenience in soiling fabric by working to what appears to be a definite point of saturation in a water suspension. (Numerous other pigments

* Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

can be satisfactorily applied in this way.) The fabric thus soiled does not appreciably change if stored for as much as six months, but it is known that fabrics so soiled will yield values which are different from those obtained by soiling with the same carbon black in an oily vehicle. The selection of a soil harder to remove than ordinary laundry soil is open to criticism. Unless the soil is difficult to remove, differences in detergents cannot be determined accurately. Soiling to saturation reduces the danger of error. It has been necessary to abandon the idea of washing to complete cleanliness as errors in determination of end point are often greater than the differences between detergents.

The choice of a soiling material free from oily constituents and thus different from most dirt which laundries are called upon to remove is recognized as a radical departure which, however, will be justified if future work confirms our present belief that in ordinary cleansing processes the oily constituents are substantially, quantitatively removed before enough of the colored pigment has been removed to make what may be called commercially clean fabric, or that the cleaning of the test pieces evaluates detergents in the same order as does commercial practice. It is not contemplated that the test with carbon black will yield valuable comparisons of detergents with respect to their ability to remove stains or that detergents containing bleaching materials can be thus evaluated.

The question whether quantitative comparisons can be arrived at by the proposed method can only be answered when many more data are at hand. The results now available indicate that within a restricted set of conditions believed to be comparable with laundry practice, it will be possible to rate individual detergents and mixtures in terms of relative cleaning value. It may eventually be possible to refer these to a definite standard such as sodium stearate, but it must not be assumed that comparisons made at one temperature and one concentration will yield results which can be applied to other temperatures or other concentrations. In the interest of advancing the knowledge of detergency it is to be hoped that a wide variety of detergents and cleaning conditions will be studied.

The proposed method appears to have the advantage of yielding comparative results of the same order with considerable variation of mechanical conditions, in which respect it appears analogous to actual practice. In offering a progress report at this time it is with the hope that numerous workers will critically examine the suggestion and report their findings in detail to the committee to the end that in the not distant future a definite recommendation of procedure can be made.

TO BRING the work to the present state of development has involved extended studies in several laboratories in which different members of the committee work. The laborious trial of methods which have eventually been set aside as unsuitable has constituted no inconsiderable part of the work and contributed to the present state of knowledge. The most useful procedure so far found is herewith offered for purposes of study:

Suggested Procedure for the Study of Detergents

THIS test depends upon the soiling of cloth with a water suspension of carbon black to the point of saturation, removal of part of the pigment and comparison of the test pieces on the basis of color.

CLOTH: The cloth used is bleached cotton sheeting weighing about 1.5 grams per square decimeter and having about 27 threads per centimeter in the warp and 25 threads per centimeter in the filling. ("Utica" brand sheeting from the Utica Steam & Mohawk Valley Cotton Mills, Utica, N. Y., was used in the work of the committee.) The sheeting should be substantially free from size before soiling.

SOILING MATERIAL: The soiling material is an extracted carbon black. (Grade "J", supplied by L. Martin Co. of Philadelphia, has been found satisfactory.) It is essential that the pigment shall disperse readily in water without the addition of a deflocculating agent.

WASHING APPARATUS: The washing machine consists of a horizontal shaft that can be rotated at a speed of 40 r.p.m. arranged to hold one-pint jars placed radially about the shaft with the base of the jars two inches from the center of the shaft. Provision is made for maintaining the temperature of the wash solution in the jars to within plus or minus 2° F., of that specified for a given test. One-pint glass-topped jars about 6 inches in height and about 3½ inches in diameter are used. (The Launderometer manufactured by the Atlas Electrical Devices Company, Chicago, Illinois and Atlas E-Z Seal jars were used by the committee.)

METHOD OF SOILING: The cloth is cut into strips, about 3½" wide and 13" long. Not less than 10 nor more than 12 grams of carbon black are suspended in 500 ml. of distilled

water in any suitable vessel. Each strip of cloth is thoroughly wet in distilled water, then stirred for a few moments in the suspension of pigment, and passed between the closely-set rolls of a clothes wringer or similar device. The treatment with pigment and the rolling are repeated until the color of the cloth ceases to become deeper. Five passes will usually be found sufficient. Without drying, each piece is shaken in a jar or wide-mouthed bottle, with successive portions of distilled water, until pigment no longer appears in the wash-water. The strips are then dried at room temperature. This method should give soiled specimens uniform and almost black in color. The brightness readings on soiled unwashed specimens should show very close to 8% whiteness as compared to magnesium carbonate with Hess Ives photometer. Samples of properly soiled specimens for comparison may be had on application to the *Chairman*. An alternative method of soiling suggested on the basis of experience in one laboratory is as follows:

Bags are made *before* the cloth is soiled rather than after. In each jar of the launderometer are placed 100 balls, a weighed amount of the carbon, 100 c.c. distilled water and two of the bags each containing 50 balls. The jars are then run in the machine at 60° C for one hour. Three 15-minute rinses with water are given. The bags are then ready for use without drying. Several bags may be dried if the brightness of the soiled material is to be measured. It may be found possible to reduce the time of the soiling and of the rinses. It is recommended that experiments with this method be made.

PREPARING THE SPECIMEN: The soiled cloth is cut into pieces of 3″ x 6″ size, folded crosswise and sewed along three sides to form a bag, 3″ x 3″ in dimension. Enclosed in each bag are 50 balls of Monel metal of ¼″ diameter, weighing approximately 60 grams, (Atlas Ball Co. of Glenwood Avenue and 4th Street, Philadelphia, Pa. are suppliers.)

PREPARING THE DETERGENT SOLUTION: The preliminary work on this test has been done with soap solutions made by dissolving 2 grams of the detergent in 100 ml. of boiling-hot distilled water, and diluting to 1,000 ml. The washing has been done at 60°C. (150°F.) Obviously, other concentrations, other temperatures, and other detergents can be studied by this method. The effect of hardness of water is also an important consideration which should be investigated.

THE WASHING TEST: (*In this test it is intended that a washing machine of the type described above shall be used. There is some evidence to show that satisfactory results may be obtained with other forms of mechanical washers.*) Heat the water in the Launderometer to 150°F. (60° C.) In each jar place 2 of the specimen bags. Heat the detergent solution to 150°F., and add 100 ml. to each jar. Close the jars and make them fast in the Launderometer, loading the shaft so as to secure approximate balance. (Tendency of the jars to leak may be checked by forcing down the wing-nuts.) Rotate by means of motor for 20 minutes at 40 r.p.m. Remove the jars, pour out the liquids, squeeze the bags by hand, recharge as before with detergent solution and repeat the process until 6 washes have been given. The bags should not be allowed to dry between treatments. After the sixth wash, each pair of bags is rinsed by placing for a few minutes in 3 successive 100 ml. portions of distilled water at 150°F. The bags are then cut open and spread on a flat surface of glass or enamel, to dry. Not less than 10 bags should be used with each detergent.

JUDGING THE RESULTS: When dry, the specimens may be compared by any method which is available to the operator. When this is done directly by the eye, care must be taken that the pieces receive exactly the same illumination. Mechanical devices are very helpful, especially in giving numerical values and in obtaining averages. The Ives tint photometer has been found satisfactory. (Palo-Meyers, Inc., of 81 Reade Street, New York City are suppliers of this device.) Plotting of results in terms of percentage of white has been found useful.

Alternatively, it has been suggested that the results be expressed as the efficiency E of a detergent under specified conditions of use by the following equation;

$$E = \frac{Bs - Bw}{Ss - Bo} \times 100,$$

in which Bs, Bw and Bo are respectively the negative logarithms of the ratios of the brightness of the soiled, the washed, and the original unsoiled cloth to that of a white standard.

The Detergents Committee now solicits the cooperation of a numerous group of volunteers each of whom is prepared to devote about two days to carrying out the proposed test in his laboratory. Identical materials and directions will be supplied with forms for reporting and the summarized results will be sent to each cooperator.

Studies in the Comparison of Detergents

Degree of Cleanliness Obtained Throughout Washing Process of Same Order as That After Maximum Number of Washes

By W. H. BURKHART and NILS FALKMAN*
Gold Dust Corporation, Baltimore, Md.

THE problem of determining the detergent properties of a soap or washing material is of great interest to soap manufacturers and users. For several years a committee of the American Oil Chemists' Society has been considering the solution of this problem. Numerous methods have been tried out in the past and gradually a method has been evolved step by step.

A little over a year ago a method of making wash tests was worked out by the committee which seemed to be a great step ahead in the solution of the problem. A reproducible method of soiling specimens was worked out by Mr. Carter and with equipment and washing procedure which had been pretty well standardized previously it was possible to make comparisons of detergents which were reproducible and apparently of considerable accuracy. The results obtained with this test were expressed as the number of washes required to wash the soiled specimens to the same color as unsoiled specimens which were carried through the test (complete cleanliness). It was found however that the method required such a long time to wash the specimens that it was valueless from a practical standpoint. It was also found that the amount of soil removed per wash, as the specimens approached complete cleanliness, was so little that the endpoint could not be determined within a range which would not comprise the endpoints of most of the common detergents.

The results during the early washes however seemed quite consistent and the differential between different detergents was quite marked. It was felt therefore that the detergent properties of different detergents could be compared satisfactorily if it could be shown that the degrees of cleanliness obtained at any fixed number of washes were in the same order as the number of washes required to obtain complete cleanliness. In order to demonstrate this, several series of washing tests were made and the color of the specimens determined after each wash. The results were expressed graphically in a coordinate system with the number of washes and percent white as coordinates. For comparison a C.P. anhydrous sodium-tallow soap and a C.P. anhydrous sodium-coconut oil soap were chosen.

Since difference in washing action is more pronounced with a pigment that is difficult to remove, carbon was decided on, the cloth (Utica sheeting) being soiled to saturation in accordance with the method worked out and demonstrated by Carter. The Launderometer was used and the washing performed according to specifications with the exceptions that all washes lasted twenty minutes and that the specimens were dried between washes. For reading the color the Hess-Ives Photometer was used, 100 percent white being indicated by a block of Magnesium Carbonate. Distilled water was used throughout the experiments, and the strength of soap solution was 2 g. in 1000 cc.

IN ORDER to determine color readings it was of course necessary to dry the specimens. To ascertain whether there was any difference when the specimens were washed in successive washes when they were dried between the washes a preliminary test was made with the coconut oil soap. Forty specimens were given eight twenty minute washes in succession and forty specimens were given the same number of washes but rinsed and dried after each wash. When the color was read it appeared that the average color of the specimens washed in successive washes was lighter (43.26% white) than the average color of the rinsed and dried specimens (40.76% white). Realizing that incomplete rinsing, leaving soap to dry on the specimens, would complicate the process, a second test was made. In the first test the rinsing water had room temperature, in the second test it had a temperature of 150° F.

* Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

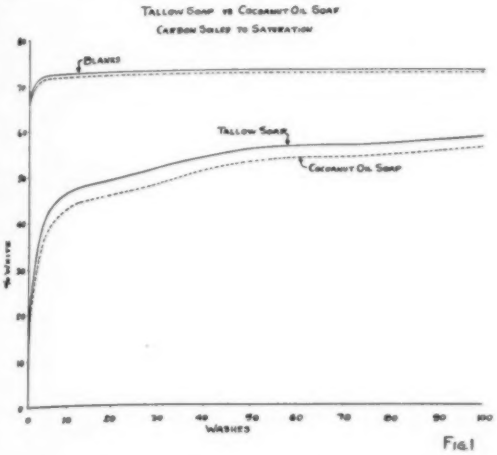

FIG. 1

When rinsing, mechanical action of course was avoided as much as possible so as not to remove part of the pigment. Therefore the specimens were soaked in the water for fifteen minutes and then squeezed lightly. The result of the second test was 43.87% white for the successive washes and 42.54% white for the intermittent ones. These results were considered close enough to justify the assumption that there is no appreciable difference in washing action whether the specimens be dried after each wash or not.

In the main test sixteen soiled and four unsoiled specimens were used for each soap. The results shown are averages of sixteen individual readings of the soiled specimens and of four individual readings of the blanks. Up to and including the twelfth wash colors were read after every wash but from the twelfth up to the one hundredth the washes were made in blocks of three, four or five with no rinsing and drying after the individual washes. If during the washing test a jar broke or started to leak the specimens were immediately discarded, this of course to eliminate disturbing factors as much as possible.

Figures 1 and 2 show the results obtained in graphical and numerical form. It will be noted that the results as shown (*Figure* 2) are not absolutely consistent. Interfering factors are many, such as mechanical action, inconsistencies in color readings etc., but the curves plotted (*Figure* 1) seem to show very definite characteristics. It should be remembered that

COMPARISON OF RESULTS. TALLOW SOAP VS. COCONUT OIL SOAP
SPECIMENS SOILED TO SATURATION WITH CARBON

Wash No.	Blank—Color % White		Soiled Cloth—Color % White		
	Tallow Soap	C.N.O. Soap	Tallow Soap	C.N.O. Soap	Difference
0	66.0	66.0	7.8	7.8	0 0
1	69.6	68.2	25.7	24.5	1.2
2	67.5	67.6	32.3	30.2	2.1
3	70.0	67.7	35.4	33.7	1.7
4	67.5	69.2	38.6	36.5	2.1
5	70 5	70.8	41.5	39.0	2.5
6	75.7	73.4	42.3	39.3	3.0
7	74.2	73.2	44.0	42.4	1.6
8	76.2	73.7	45.5	41.2	4 3
9	72 9	71.9	46.0	42.7	3.3
10	73.9	73.9	45.8	43.8	2.0
11	74.7	73.9	47.7	43.2	4.5
12	73.9	71.2	45.7	42.7	3.0
14	73.4	70.7	46.9	43 3	3.6
17	73.4	71.7	48.4	45.3	3.1
20	71.4	72.9	48.5	45.6	2.9
23	71.2	69.4	49.6	46.1	3.5
26	68.7	70.4	50.3	47.4	2.9
29	69.7	69.9	50.9	47.8	3 1
32	70.2	70.2	51.8	48.7	3.1
35	72 2	73.7	53.1	50.7	2.4
39	68.4	66.4	52.1	50.7	1.4
43	67.9	67.9	52.7	52.7	0.0
46	72.2	72.2	54.4	52 4	2.0
49	70.4	73.2	55.9	53.8	2.1
53	68.9	70.7	55.3	52.9	2.4
58	69.4	72.4	58.8	54.3	4.5
61	72.9	—	57.4	—	—
65	69.4	70 7	53.9	52.2	1.7
72	65.9	69.2	55.9	51 9	4.0
75	68.9	68.2	55.6	53.0	2.6
80	70.2	69.7	56.2	52.8	3.4
85	71.5	69.4	55.9	54.0	1.9
90	71.9	73.7	56.3	54.5	1.8
94	70.4	69.7	57.6	54.9	2 7
100	70.7	71.4	57.7	55.7	2.0

FIGURE 2

the color readings are averages. There is a distinct difference between the results with the different soaps after the first wash. This difference seems to reach a maximum between the eighth and fourteenth washes. From this point on the curves remain practically parallel, possibly converging slightly.

A second series of tests was run using a soap this time consisting of 50% C.P. anhydrous sodium tallow soap and 50% C.P. anhydrous sodium coconut oil soap. In one case this soap was mixed 75% soap and 25% sodium carbonate solids and in the other case 75% soap and 25% "N" brand sodium silicate solids. The strength of the solutions was again 2 grams in 1000 cc. The procedure was repeated exactly as in the first series of experiments except that the test was carried to only twenty washes. *Figures* 3 and 4 show the results obtained in graphical and numerical form. The results follow very closely in every respect with those obtained in the first series.

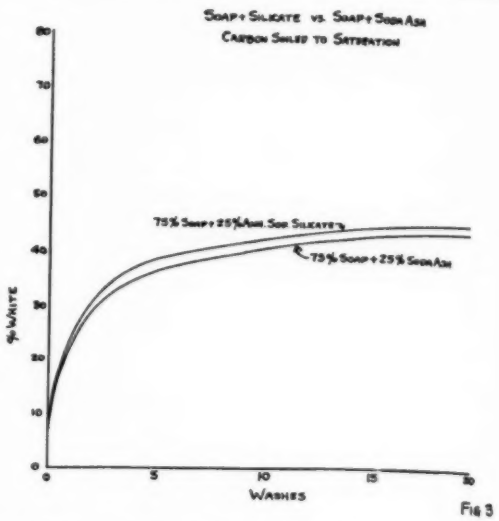

FIG 3

COMPARISON SOAP AND SILICATE VS. SOAP AND SODA ASH
SPECIMENS SOILED TO SATURATION WITH CARBON

Wash No.	Soap and Silicate Color % White	Soap and Soda Ash Color % White	Difference
0	7.48	7.48	0.00
1	24.29	22.09	2.20
2	31.76	29.52	2.24
3	34.52	32.56	1.96
4	36.58	34.85	1.73
5	38.69	36.02	2.67
6	38.02	37.19	0.83
7	38.97	37.47	1.50
8	39.80	39.07	0.73
9	39.97	39.19	0.78
10	41.41	40.36	1.05
12	42.40	42.02	0.38
14	43.52	43.08	0.44
16	44.25	43.41	0.84
20	45.30	44.19	1.11

FIGURE 4

IT WILL be noted that in none of the tests, even those run to 100 washes, did the color come up to complete cleanliness (the color of the blank). It had been expected when the tests were started that the point of complete cleanliness would be reached. It is apparent that the color of the washed specimens is not going to reach the color of the blanks within any reasonable number of washes. In fact it seems doubtful if this point can ever be reached when the specimens are soiled to saturation with carbon. It is desirable though to try to obtain some definite demonstration that the degrees of cleanliness obtained with different detergents at any fixed number of washes are in the same order as the number of washes required to obtain complete cleanliness.

Two additional sets of tests were then run using specimens less heavily soiled so that they could be washed more rapidly. The specimens for one set were soiled to saturation with umber and for the other set were lightly soiled with carbon. Two series of washes were run on each set, one series with C.P. anhydrous coconut oil soap and the other with C.P. anhydrous tallow soap. The washes were continued to as near complete cleanliness, that is, the color of the blanks, in each series as possible. The results of each series are expressed graphically and numerically in *Figures* 5, 6, 7, and 8. It will be noted that the umber soiled specimens show numerous discrepancies during the early washes. This is to be expected since the soil is so easily removed. But that the curves are in the proper order during the latter washes and that the curve representing washes with tallow soap meets its blank after about seventeen washes whereas twenty-eight washes are required for the curve representing coconut oil soap to meet its blank.

The series lightly soiled with carbon show reasonably consistent results throughout but time was not available to carry the results quite to the point of complete cleanliness although

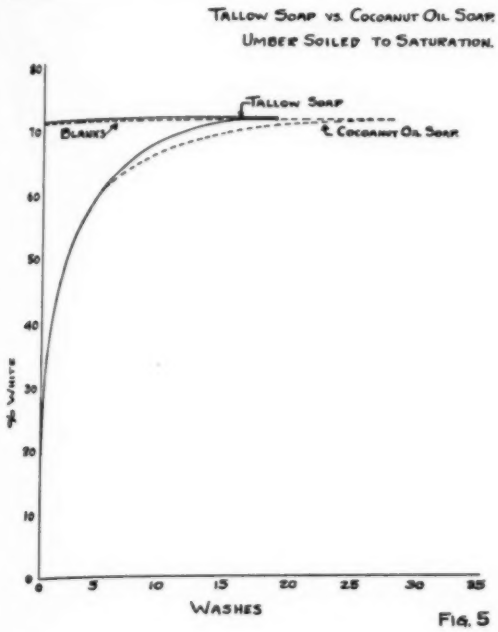

FIG. 5

they have approached very closely and the results remain in the proper order. In fact it looks doubtful again whether the color of the washed specimens even lightly soiled with carbon will ever reach the color of the blanks. Apparently the last traces of carbon soil are too difficult to remove and even if sufficient washes could be made to accomplish this the results as the color of the specimens approaches the color of the blanks would not be sufficiently accurate to be reliable.

In conclusion therefore it seems that the majority of the data supports the original hypothesis that the degrees of cleanliness obtained with different detergents remains in the same order throughout the washing process so that detergents may be correctly compared after a limited number of washes. It will be noted that the results are most consistent in the majority of the tests during the early washes due to the fact that the most soil is being removed per wash during this time.

IT SEEMS logical therefore to recommend the following procedure as a standard test for comparing detergents.

1. Use standard method as detailed in 1930 except all washes twenty minutes. No unsoiled blanks required.
2. Soil specimens to saturation with carbon black as worked out by Carter. Do not use less than ten specimens.
3. Make six twenty minutes washes in succession.
4. Compare average color of washed bags after drying either by color readings or by eye and rate detergents accordingly.

If standard equipment, standard methods, standard sheeting and standard carbon black are used the results may be expressed numerically since no trouble has been experienced in checking results if an average of a number of washes is used. It has been found that the test may be carried out in different washing equipment using different sheeting and different soil with equally satisfactory results relatively, although of course the results will not check numerically with results run by the standard method. It has been suggested that an index wash be run in each series either with C.P. sodium stearate or plain water which

COMPARISON OF RESULTS. TALLOW SOAP VS. COCONUT OIL SOAP
SPECIMENS SOILED TO SATURATION WITH UMBER

	Blank—Color % White		Soiled Cloth—Color % White	
Wash	Tallow Soap	C. N. O. Soap	Tallow Soap	C. N. O. Soap
0	70.99	70.99	19.54	19.44
1	71.19	71.19	41.69	43.33
2	73.44	70.44	50.83	49.08
3	71.44	71.19	58.65	56.86
4	70.94	70.69	57.70	58.65
5	71.19	71.44	60.85	60.15
6	70.69	70.94	62.86	63.23
7	71.19	71.19	64 54	64.84
8	71.19	71.19	65.12	63.38
9	71.19	70.94	66.56	65.86
10	70.94	71.19	68.04	67.20
11	71.19	71.19	67.82	67.39
12	70.19	70.69	66.75	65.90
13	69.34	69.19	65.81	67.66
14	70.19	70.19	67.40	69.12
17	71.19	70.19	70.82	69.46
20	71 00	70.19	70.07	68.07
23	71.00	70.19	70.20	68.80
28	——	70.19	——	70.70

FIGURE 6

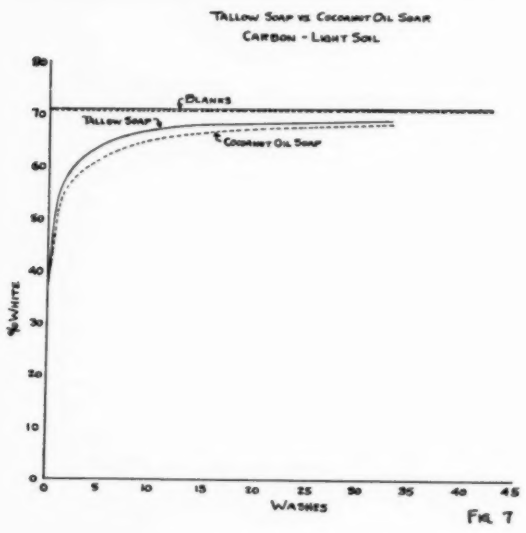

FIG. 7

can be used as an index from which all results can be expressed. In this case numerical results can be obtained under any conditions. Some work done along these lines shows considerable promise. It may be interesting to note that while color readings are desirable they are not necessary since a large number of tests have indicated that the eye can distinguish a difference of 1 percent whiteness easily.

It should be borne in mind that there are certain limitations to the above method namely:

1. That only one general type of soil has been tried i.e., inorganic materials, umber and carbon black and on only one type of fabric. Whether the same results would be obtained with soils containing greasy material is questionable. It has been suggested that in view of the difficulty of removing carbon black all other soils, except possibly stains, would come out long before the carbon in which case the results with carbon would be a true index of detergency regardless of the type of soil.

2. An average of a number of not less than ten specimens must be taken to correct inconsistencies in individual washes.

3. The procedure and results obtained are known to hold only with the common types of washing materials usually dealt with and may not be satisfactory for detergents of special types such as those containing solvents, bleaching materials, etc.

It is felt that the test as outlined above supplies a tool which is practical and which if used with discretion by an intelligent operator who understands its limitations will give comparisons of detergents which are dependable.

COMPARISON OF RESULTS. TALLOW SOAP VS. COCONUT OIL SOAP
SPECIMENS SOILED LIGHTLY WITH CARBON

	Blank—Color % White		Soiled Cloth—Color % White	
Wash	Tallow Soap	C. N. O. Soap	Tallow Soap	C. N. O. Soap
0	70.99	70.99	37.57	37.69
1	71.19	71.19	56.44	54.57
2	73.44	70.44	60.32	56.82
3	71.44	71.44	63.82	59.19
4	70.94	70.69	63.52	60.52
5	71.19	71.44	65.19	62.02
6	70.69	70.94	62.86	63.69
7	71.19	71.19	65.52	63.69
8	71.19	71.19	66.19	64.02
9	71.19	70.94	65.69	63.86
10	70.94	71.19	67.52	62.02
11	71.19	71.19	62.69	66.02
12	70.19	70.69	64.52	65.69
13	69.34	69.19	64.19	64.86
14	70.19	70.19	66.86	65.36
17	71.19	70.19	68.52	68.19
20	71.00	70.19	68.02	66.86
23	71.00	70.19	68.90	67.99
28	71.00	70.19	68.36	67.99
33	70.70	70.50	68.86	68.69

FIGURE 8

Since the formation of spots in soaps is analogous to the temperature increase of olein in the Mackey test, both being dependent upon oxidation, it has been suggested that it would be of benefit to introduce the Mackey test into the soap industry for testing the color permanency of soaps and fats or their liquid fatty acids during oxidation. *Seifensieder-Ztg.* 58,291-2 (1931). In this connection it is noteworthy that it has been recently announced that the material and design of the "cage" of the Mackey apparatus affect the results obtained in the apparatus. Nichrome cages have been suggested. *Chimie & Industrie* Special No., 650 (March, 1931).

Decolorizing Carbon Analyses and Tests

Describing in Detail Methods for Evaluation of the Quality and Effectiveness of Bleaching Carbons

In Two Parts—Part I

By M. T. SANDERS*

THE methods described in this article are those in use in the factory and experimental laboratory of a large manufacturer of decolorizing carbons. In compiling this paper no attempt has been made to include every conceivable test of carbons, but only those tests which will be of help to the user of carbons and which will aid him in making an intelligent selection of a carbon for his purpose. The author will welcome any suggestions for additions or improvements.

Moisture

WEIGH out approximately ten grams of the carbon into a crystallizing dish fitted with a cover. Remove the cover and place the dish in an electric oven. Dry overnight at 140° C. (Drying at 105° C. does not remove the last trace of moisture.) Place the dish and its cover in a dessicator to cool. When cold, replace the cover on the dish and weigh the dish, cover and carbon. The loss in weight is taken as representing the moisture present.

Calculation:—

$$\frac{\text{Loss in weight of carbon} \times 100}{\text{Weight of carbon taken}} = \%\ \text{moisture}$$

It is necessary to cover the dish containing the sample as the dried carbon absorbs moisture very rapidly. Save this sample for the determination of water soluble matter.

Screen Test

A THOROUGH separation of carbon into the respective mesh is possible only by water screening. The procedure is as follows:

Size of Sample.

A convenient size of sample is between 7½ and 10 grams of carbon.

Preparation of Sample.

Place the sample of carbon of known dry weight, in a liter beaker and wet the sample with water, taking care to avoid the loss of dust. Fill the beaker about two-thirds full of water. Stir the mixture. Thorough wetting of the carbon is necessary to the ease of separation on the screens.

Preparation of the Screens.

Before being used, the screens must be cleaned, inspected for holes and thoroughly wet.

When screening with water, small particles of carbon lodge between the wires of the screen and are not readily removed by passing water through the screen from either side. These particles may be removed by lightly brushing the screen with a test tube brush and at the same time washing the screen with a gentle stream of water from a laboratory hose.

Stack the wetted screens in the same manner as for dry screening, but with the top cover and bottom pan omitted. Apply water to the top screen and note whether it passes readily through the screens.

Transfer of the Carbon to the Screens.

The "s'imes" (the very fine carbon which floats on the water) give the most trouble, as it is practically impossible to thoroughly wet this fine material. Practically all of the "slimes" will pass the 300 mesh screen, and it is well to be rid of them at the beginning of the test. Accordingly, let the sample in the beaker settle. Pour the top part on the top screen and wash the carbon through the screens, using a gentle stream of water from a hose.

If the entire sample, even with the "slimes" removed, were put on the screen at once the lower screens (of finer mesh), would become plugged and the water would not pass through. Unless this condition is noticed at once, the plugged screen will overflow and the test will be ruined.

For this reason, transfer the sample to the screens slowly, passing a gentle stream of water

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through at the same time. It is necessary to watch the amount of carbon collecting on the 200 and 300 mesh screens. If the sample be added too rapidly the fines will not have time to be washed through these small mesh screens, but will cover these screens and flood them.

When the sample has been transferred to the screens, wash out, with the hose, any particles of carbon which may remain in the beaker. Continue to add water to the top screen until no particles of carbon are seen coming out of the bottom screen.

Determination of completeness of separation.

Place the screens over a large, white porcelain evaporating dish and collect, in this dish, the water passing through the screens. Any particles of carbon which pass the screens can readily be seen on the white surface.

This method, however, does not show absolutely that the separation is complete, when a stack of screens are used, as the water may channel. Accordingly, when the washing of a stack of screens seems complete, it is necessary to take each individual screen and test it in the same manner.

To do this, start with the top screen, wash it with the hose and collect the water in a large evaporating dish. If it contains carbon, put this water with the carbon through the remainder of the stack. Continue this procedure until the water from this screen comes free from carbon particles. Repeat this method with each screen. When all the screens have been thoroughly washed, the carbon is ready to be transferred for weighing.

Transfering of various mesh carbon for weighing.

By means of a stream of water from the hose, transfer the carbon remaining on each screen, into separate beakers. Transfer the carbon in each beaker into a separate tared Gooch crucible fitted with an asbestos mat. Dry the crucibles and carbon in an oven at 140° C. Cool them in a dessicator and weigh them. The weighing must be done rapidly as the dried carbon absorbs moisture readily.

The net weight of carbon in each Gooch crucible times 100, divided by the dry weight of the original sample, gives the percent of carbon of each size.

The amount of carbon passing the 300 mesh screen is taken by difference.

The screens usually employed are of 100, 200 and 300 mesh. However, one can use the screens which will give him the information he seeks.

Apparent Density

THE apparent density of a carbon is determined by measuring the volume occupied by a known weight of carbon when packed so that it will not decrease in volume by continued tamping, or by measuring the amount of carbon which may be packed in a container of known volume.

Determine the approximate weight of *dry* carbon necessary to fill a 100 c.c. graduated cylinder to the top graduation. Weigh out this quantity of dried carbon and transfer it to the cylinder. Stopper the top of the cylinder to avoid loss of dust and fine particles of carbon. Tamp the carbon to the minimum volume which it will occupy, by tapping the cylinder on a table until no further settling occurs. A large rubber stopper will make a good buffer between the table and the bottom of the cylinder.

Read the volume occupied by the carbon. The apparent density is equal to the grams of dry carbon taken, divided by the volume, in c.c., occupied by the packed carbon.

Oil Saturation Value (O. S. V.)

THE O. S. V. of a carbon is expressed as the grams of cotton seed oil required to wet 100 grams of carbon.

The test is carried out as follows:—

A small weighed sample of carbon (about 5 to 10 grams) is placed in a 250 c.c. porcelain casserole. The clear cotton *seed* oil is added drop by drop. After each addition, the carbon is stirred gently, care being taken to see that all traces of oil have disappeared before adding more oil. The carbon mass will ball, either forming one or a few large lumps, or remain in smaller lumps which, however, will adhere together towards the end. The character of the mass makes no difference as long as no oil is added while traces of it are still visible. The end point is reached when the casserole shows the first trace of streakiness. This becomes quickly apparent, for previous to the addition of the last few drops, the surface of the casserole becomes perfectly clean and bright.

The oil saturation value is expressed as grams of oil per 100 grams of dry carbon. If the oil has been added from a burette the volume is known and knowing the specific gravity of the oil, the O. S. V. is readily calculated.

The O. S. V. of a carbon is a function of the apparent density. After the section entitled, "Oil Retention Value," will be found Table I. which gives the "Apparent Density," "Oil Saturation Value" and "Oil Retention Value" of practically all grades of various commercial decolorizing carbons and a discussion of these properties.

Oil Retention Value (O. R. V.)

THE oil retention value is a measure of the oil held in the cake of a filter press after blowing the press. It is expressed as grams of oil per 100 grams of carbon.

The O. R. V. shown in Table I. were determined as follows:

One hundred grams of carbon (dry basis) were mixed with four liters of refined, unbleached cotton seed oil and heated to 50-55° C. This mixture was then filtered through a laboratory plate and frame press which had been pre-heated by blowing steam through it for ten minutes before filtering. 30-40 pounds pressure were used for filtering the carbon-oil mixture. After filtering, the press cake was treated as follows:

1. Cake blown with air for 15 minutes at 40 lbs. pressure.
2. Cake blown with steam for 15 minutes at 30 lbs. pressure
3. Cake blown with air for 10 minutes at 40 lbs. pressure.

The cake was removed from the press, thoroughly mixed and the oil retained in the cake was determined by extraction.

TABLE I.

Carbon Number	Apparent Density Grams per C.C.	Gms. oil per 100 gms. Carbon O.S.V.	O.R.V.
1	0.245	258.0	105.0
2	0.252	249.0	98.4
3	0.270	220.0	105.0
4	0.275	222.0	93.0
5	0.288	183.0	72.4
6	0.292	185.0	71.4
7	0.295	204.0	75.2
8	0.310	179.0	70.3
9	0.320	175.0	68.3
10	0.390	148.0	39.0
11	0.485	125.0	36.1
12	0.515	118.0	33.0
13	0.540	110.0	29.0
Bone Char	1.00	50.8	18.3

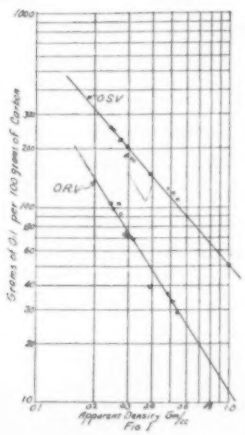


FIG. I

If the logarithm of the O. S. V. be plotted against the logarithm of the apparent density, it will be found that the points fall nearly on a straight line. Likewise, a logarithmic plot of the O. R. V. against the apparent density gives a straight line. These curves are shown in Figure I.

We see from an inspection of these curves that a carbon of high apparent density will retain a much smaller quantity of oil in the press cake than will one of a low apparent density.

Filtrability

FILTRABILITY tests made on a Buchner funnel do not mean a great deal. The best way to test the filtrability of a carbon is to filter a full size works' batch in the works' filter press. If this is undesirable, some idea of the filtrability of a carbon may be gained by the use of a laboratory filter press, for instance, one with 6 inch frames, offering ¼ square foot of filtering area per filter cloth.

When testing two carbons for filtrability the same pressure and temperature should be used in each case. This pressure and temperature should be approximately that used on the large presses in the plant. The rate of flow of the filtrate should be determined. One should also note the time elapsing between the start of the liquor through the press and the time at which the filtrate becomes clear.

The rate of filtration is ordinarily reported as gallons of filtrate per square foot of filtering surface per hour.

Water Soluble Matter

TAKE the ten gram sample which was used for the moisture determination and transfer it to a 600 c.c. tall form beaker, with lip. Add 200 c.c. of distilled water. Heat on an asbestos center gauze until the mixture begins to boil, stirring continually during the time of heating. Remove the flame and stir the contents of the beaker for five minutes. Allow the carbon to settle and then decant the clear, supernatant liquor through a tared Gooch crucible fitted with an asbestos mat.

Repeat the digestion three times, each time adding a 200 c.c. portion of distilled water to the residue in the beaker.

After the fourth digestion, transfer the carbon to the crucible, suck the mass as dry as possible and then dry the crucible and contents over night, in an electric oven, at 140° C. Cool the crucible and contents in a dessicator and weigh.

$$\frac{100\ (\text{dry weight of carbon—wt. after extraction})}{\text{dry weight of carbon}} = \%\ \text{total water soluble matter. (dry basis.)}$$

Experiments have shown that more than four extractions are not necessary, as even sixteen extractions do not increase the result by as much as 0.05% water soluble matter.

Ash

THE ash is determined as follows:—Two grams of carbon of known moisture content, are weighed out into a porcelain crucible 42 m.m. top diameter and 35 m.m. depth. The crucible is then placed in an oven and dried at 140° C. for several hours. After drying, the crucible is placed on a Nichrome triangle and ignited with the flame of a Meker burner, cooled in a dessicator and weighed. The ignition is repeated until the loss in weight after 15 minutes ignition amounts to less than 1 mg.

$$\%\ \text{Ash (dry basis)} = \frac{\text{dry weight of carbon taken}}{100 \times \text{weight of ash}}$$

It will be found that if the carbon be ignited directly after weighing out the sample, without the preliminary drying in the electric oven, the moisture or adsorbed air will be suddenly liberated, throwing part of the carbon from the crucible.

The ash is a great aid in the identification of the source of a carbon, as the appearance of the ash of various brands of carbon is quite characteristic. Scarcely any two of them have the same color and form. It so happens that when the color and structure of the ash from two carbons are similar, the percentages of ash differ widely.

Method of Determining the pH of a Carbon (Acidity or Alkalinity)

THE term "pH of a carbon" is somewhat misleading. It is in reality the pH of water which has been in contact with a carbon under certain specific conditions. The pH will vary with the ratio of water to carbon used, the time of contact of the water with the carbon and the temperature of water while the carbon is in it. The following was decided upon as standard.

Weigh 100 grams of dry carbon (or its equivalent of moist carbon) into a 2 liter balloon flask of Pyrex glass, cover with 1 liter of freshly boiled distilled water, fit the flask with a 15″ reflux condenser (Liebig) and boil for 1 hour. (In case there are acid or ammonia fumes present in the laboratory, fit the top of the condenser with a cork stopper and a piece of glass tubing that will extend outside of the laboratory.) At the end of this period remove the flame, allow the carbon to settle and then by means of a 20 ml. pipette with an extension, remove through the top of the condenser a small sample of the supernatant liquid while it is still hot (90° C.). Remove the extension from the pipette, cool the sample under the tap and transfer it to the hydrogen electrode vessel and determine its pH in the usual way or transfer 10 c.c. of it to a small test tube and determine its pH colorimetrically.

The electrometric method is considered the standard method for the determination of pH while the colorimetric method is only a quick and easily operated substitute method. The latter method gives the results accurate to within ± 0.2 pH units in ordinary cases, but in the range just below the neutral point the accuracy is considerably less, due to small amounts of acid or alkali and lack of buffer salts. The errors, however, should be reasonably constant, and with careful work and good manipulation the results should be comparative.

The materials required—Lamotte color standards (contained in sealed glass ampoules) and corresponding indicator solutions, covering the pH range desired, several test tubes with 10 c.c. graduations and of same glass and diameter as ampoules, and several 1 c.c. pipettes with mark to deliver 0.5 c.c.

Procedure—If the sample (water solution referred to above) contains carbon, filter it through a small filter paper into another 10 c.c. test tube. Add to the clear solution 0.5 c.c. of the indicator solution covering the pH range which the solution is suspected to be within, stopper the test tube with a small rubber stopper, invert the test tube a few times and then match the color obtained with one of the color standards which is made up with 10 c.c. of the buffer solution and .5 c.c. of the same indicator. Estimate the pH to the nearest tenth of a unit.

Precautions must be taken to prevent the access of carbon dioxide as far as this is possible, especially after the solution is filtered. The work should be carried through rapidly, and the tubes kept stoppered. This is particularly necessary when the sample is nearly neutral.

The most important point is to have proper lighting for matching colors. It was found that for solutions without color or turbidity, an ordinary test tube rack with a sheet of filter paper in back of it is satisfactory, furnishing an even, white background.

The color standards should be protected from heat and direct sunlight. With the exception of the set covering the very low acid range, they are fairly permanent. Those sets

covering the pH range 3 to 9.6 should be checked up at least once a year.

The method outlined above for the determination of the pH of a carbon has been thoroughly tested in the laboratory of the Darco Corporation and has been found to give consistent results. Equilibrium is so slowly reached that it is necessary to boil the mixture of carbon and water for one hour. At room temperature, equilibrium is so slowly attained that the results will not become constant even after many hours of shaking the mixture.

Decolorizing Ability of a Carbon

IT HAS been our experience that the removal, by carbons, of color from liquids follows Freundlich's adsorption equation. This equation is:

$$X/M = KC^{1/n} \quad \text{.....(1)}$$

Where X = amount of Solute adsorbed,
M = grams of carbon used,
C = concentration of Solute after adsorption.
K and 1/n are constants.

Since we are ordinarily interested in the color of the solution rather than the actual concentration of the colored substance, we use certain "color units" in place of the concentration terms X and C of Freundlich's equation.

It is known that the transmission of light of any given wave length (color) through a colored solution is according to the following equation, provided that the colored substance does not undergo chemical change with change in concentration.

$$I/I_o = e^{-kdm} \quad \text{.....(2)}$$

Where I = the intensity of the light emerging from the solution.
I_o = the intensity of the light entering the solution.
e = the base of natural logarithms.
k = a constant.
d = the distance which the light travels through the solution.
m = the concentration of the colored substance in the solution.

If we let $I/I_o = T$

Where T = the fraction of incident light transmitted by the solution—we can re-write equation (2) as follows:

$$m = \frac{-\log_e T}{kd} \quad \text{.....(3)}$$

Therefore, in place of C and X in equation (1), we can use any system of color units in which the color units are proportional to the logarithm of the fraction of light transmitted.

Equation (2) holds only for monochromatic light. The eye is affected by all colors. The effect on the eye of the color of a substance is measured by the area under the curve obtained by multiplying the energy values of the light of each wave length by their relative abilities to produce light sensation (luminosity). (See Luciesh—Color and Its Applications," published 1915 by D. Van Nostrand Co., New York, pages 35-36, 209-210.) Such a scheme is followed by the Bureau of Standards in their method of measuring the color of sugars where the spectral transmission curves of the different sugars vary somewhat. The Bureau of Standards' system of color measurement, as applied to sugars, is described in "Sugar," May 1925, pages 223-224. The Bureau also uses a function which they designate as "Q" which is the ratio of the negative logarithm of the transmission of light of a given wave length to the negative logarithm of the transmission of light of 560 millimicrons. This "Q" ratio is useful in studying the effect of various reagents and treatments on sugar solutions. The Bureau of Standards' color unit is based on a sugar concentration of one gram per cubic centimeter and a layer one centimeter thick. For our present purpose of comparing the degree of activation of two carbons, we do not need to use the Bureau units, although it would be well to do so in order to follow a standard system.

In the example given later in this manual, we reduce the color units to the basis of a layer of solution one centimeter thick, but as we use a molasses solution, we do not reduce the color units to a basis of one gram of solids per cubic centimeter of solution.

At the Darco Laboratory the system of color units described in "Chemical and Metallurgical Engineering," March 21, 1923, page 541 is still in use. We intend to continue using this system until the method of measuring the color of solution is standardized, at which time a change in method will probably be made.

This last named system is a modification of that of Meade and Harris described in "Industrial and Engineering Chemistry," Vol. 12, page 687 (1920). Meade and Harris' system was thus modified in an attempt to have the color units more nearly represent the color of the solution as it affects the human eye.

(To be Concluded)

■

It is said that the difference in iodine number of the unsaponifiable matter in olive oil and that in the oils commonly used as its adulterants can be used in determining adulteration in amount of 5% or less. The iodine number of the unsaponifiable is 197-206 in olive oil and 117-124 in the adulterating oils. *Olii minerali, olii e grasi, colori e vernici,* 11,9-10 (1931). *Chem. Abstr.* 24,4140 (1931).

■

In a recommended process for the saponification of liquid soaps, boiling in two stages is advocated. The difficultly saponifiable fats are boiled first; the remainder of the charge is added later, and next day enough olein is added to bring the alkalinity to 0.1 per cent, after which enough softened water to produce the desired concentration is added. *Seifensieder-Ztg.* 58,340-1 (1931).

The Circulating Rendering Process

Describing a Revolutionary Development in the Modern Art of Fat Rendering from Edible and Inedible Materials

By Oscar H. Wurster
President, Wurster & Sanger, Inc., Chicago, Ill.

IT IS the purpose of this paper to describe the Circulating Rendering Process[2] invented by Mr. T. K. Lowry, General Superintendent of Darling & Company, Chicago, Illinois, and developed at the Chicago Plant of Darling & Company.

Definition of Rendering

IN A broad sense the term rendering is applied to the combined operations carried out in rendering plants by the rendering industry.[3] In its more limited and specific meaning rendering "is the term applied to the trying out of animal fats, whether edible or inedible; that is, to the separation, by means of heat, of fat from tissue and cellular structure. In the trade a further distinction is sometimes made, extraction at high temperatures being called 'rendering', and extraction at low temperatures, 'melting'."[4] Rendering is also described as the extraction of oil by boiling out with water and as consisting of the process which involves heating of the tissues containing the oils or fats so that the cell membranes burst and the liquid fat flows out.

I emphasize the definition and meaning of rendering because in conceiving and developing the new Circulating Rendering Process the questions which naturally came first were: (1) What does rendering consist of, basically? (2) How are the basic requirements fulfilled by the old methods? (3) How can these basic requirements be accomplished more efficiently and economically, more in line with our present ideas of the proper conduct of process operations and in the light of our present engineering knowledge and experience?

[1] Presented at the Fifth Fall Meeting of The American Oil Chemists' Society, Chicago, Ill., October 29, 1931.
[2] Patents applied for in the United States and foreign countries.
[3] Cf. L. B. Zapoleon, "Inedible Animal Fats In The United States" p. 175; Fats and Oils Studies of the Food Research Institute, No. 3, Stanford University, California, December, 1929.
[4] Ibid. p. 77.

Former Methods of Rendering

RENDERING in the past has been carried out by three general processes known as kettle, wet, and dry rendering. Kettle rendering is carried out by heating the material in an open kettle with direct heat or with steam heat in a jacketed kettle, and with hand or mechanical agitation. Usually some water is added to prevent local overheating or scorching at the start of the operation.

Wet rendering, also termed steam and pressure rendering, is carried out in a closed tank. The material is charged into the tank or digester and is then subjected to a steam pressure of about 40 pounds, with open steam. These digesters, in general, do not have mechanical agitation, but one modification which provides for subsequent drying in the same vessel is so equipped. By this process considerable water is introduced and its final disposition must be provided for in subsequent operations.

Dry rendering is carried out in a closed, horizontal or vertical dry-cooker or dry-melter, either at atmospheric pressure or under pressure or vacuum, or with a combination of these conditions. The heating steam in the jacket is usually at 40 to 50 pounds gauge pressure. The cooker is provided with a heavy mechanical agitator to keep the heating surface clean, to facilitate the heat transfer and to prevent local overheating and scorching of the material. A priming charge of fat may be added to the charge of material before the heat is turned on.

In all rendering processes the fatty matter is preferably cut up into small pieces before being charged to the rendering vessel. This facilitates uniformity in the heating and cooking of the material and the consequent breaking of the fat cells and, also, the exudation of the fat from the solid material.

Objections to the Old Rendering Processes

OPEN kettle rendering is, of course, slow owing to the relatively small heating surface and consequent slow rate of heat transfer. When carried out in a direct-fire-heated kettle the process is wasteful of fuel and the fat has a scorched taste, is dark colored and is of variable quality. Rendering in open, steam jacketed kettles, conserves fuel, permits better heat control, and produces a more uniform product. The operation is, however, a slow one, does not entirely prevent scorching, and introduces complications such as increased F.F.A. due to the time element. It does not adapt itself to economical large scale production.

Since open kettle rendering is slow and not suitable for materials low in fat content because the recovery of fat is incomplete, there was developed the wet rendering process in which the fatty material is disintegrated by the direct application of steam under pressure. Most lard, prime steam lard, is today produced by this process.

The objections to wet rendering are the temperature required, usually that of steam at 40 pounds pressure, the time required, which is usually 7 to 10 hours, the production of tank water and necessary recovery of the nitrogen values therefrom, and the consequent complications of the process involved in recovering the fat, tankage and nitrogen content of the tank water.

With the above enumerated objections to open kettle and wet pressure rendering, the open kettle process was developed into what is now known as the dry rendering process. The comminuted mass is heated with agitation and melted in its own fat and moisture. As carried out, the process is a necessary compromise between the greatest possible economy of operation and a satisfactory product. The heating surface is relatively small, therefore the heat transfer is slow. The maximum steam pressure permissible in the jacket is 40 to 50 pounds. Even this temperature affects the color of the fat and there is scorching of the products. There is also a formation of gluey or mucilaginous materials at the temperature and under the conditions of the dry rendering process. The process requires from 3 to 10 hours, depending on the material and the size of the melter. The power required for the heavy agitator which turns over the mass and rubs it against the shell is high and the upkeep of cookers is high due to wear and tear of the agitator and internal friction of the material on the shell of the cooker.

Origin of the Circulating Rendering Process

WITH the merits and disadvantages of the above three rendering processes in mind, Mr. Lowry concluded that what was needed was a process which combined (1) quick heating, to reduce the time element and its effect upon color and F.F.A., (2) low temperature of the materials, to prevent discoloration and scorching, to keep down the F.F.A. and permit the use of exhaust steam at low pressures, (3) large batches to meet modern manufacturing requirements, (4) economical operation as regards steam, power and labor.

The quick heating and low temperature specifications required a relatively large heating surface with a rapid heat transfer. This indicated a tube heating surface such as has been adopted for boilers, evaporators, stills, and other heating equipment. The rapid heat transfer would need to be accomplished by forced circulation.

Considering the nature of the materials which are rendered and their physical conditions, the possibility of circulating them through heating tubes by pumping raised many questions and problems. It had not been done and there was naturally the question of whether or not it could be carried out practically.

Using low temperatures would permit the use of exhaust steam and affect a great economy of operation. To use a low rendering temperature and exhaust steam for heating would require carrying out the process under vacuum. Just how the materials in process would act in a circulating rendering system carried out under vacuum remained to be determined. There was no experience or data available on the question.

In other words, the problems of pumping the mixed solid and liquid materials, passing these materials through heating tubes, possible frothing of the materials under vacuum as the moisture passed off, and necessary operating conditions could not be solved except by actually building and operating a plant. There was no data or experience available on the exact relation of the temperature and time factors of rendering under different conditions. Assuming that, from calculations, the proper heating surface was provided to give a certain heat transfer in a given time, there was no definite knowledge or data to assure that in this time and at the temperature of operation with a high vacuum the material would be rendered and in proper physical condition for subsequent handling. The characteristics of the materials to be handled and the circulating

process involved precluded the possibility of successful experimental or pilot plant operation. However, the possibilities, were considered sufficient to warrant proceeding with a commercial size unit and the design and construction of a plant were started early in 1930.

Description of Process and Equipment

THE Circulating Rendering Plant consists of a tubular heating element with vertical tubes through which the material passes. The tubes are heated by exhaust steam at pressures below 5 pounds gauge. The material is drawn from the bottom of the tubes by a centrifugal pump of the non-clogging impeller type and is discharged at a point immediately above the top of the tubes to maintain circulation at this point and prevent clogging of the tubes. Above the heater is a large flash chamber in which the separation of the vapor from the liquid takes place. The vapor is drawn off from the flash chamber through a separator to a barometric condenser. A 2-stage steam-jet air ejector is connected to the barometric condenser to obtain the vacuum.

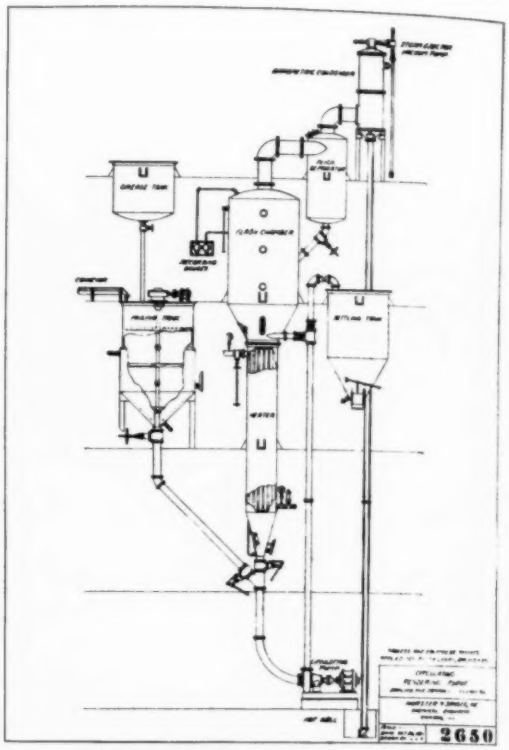
The material is ground and conveyed to a steam jacketed mixing and charging tank provided with an agitator in which it is heated before pumping into the heater and flash chamber. Whether or not a priming charge of fat is added depends on the kind of material, its physical condition and the amount of fat and moisture it contains.

After pumping the warmed material into the circulating system it is circulated through the heater until it is rendered and is then discharged into a settling tank. The fat is drawn off from the settling tank and the cracklings, or greaves, are run to the presses.

Operation of the First Unit

THE first unit built was designed for a total capacity of 20,000 lbs. material per charge, including priming fat. The average charge as the plant now is operated is slightly larger. The heater has slightly over 1,000 sq. ft. of heating surface with tubes of 4″ outside diameter. Of the anticipated possible difficulties, it is of interest to note that frothing which became a problem with some materials has been overcome. The flash chamber is seven feet in diameter and has ample capacity for the release of the vapors from the liquid. The clogging of tubes has not been serious and has been overcome. The solids are in process of shrinking throughout the cooking operation, and the individual pieces entering the tubes naturally become smaller as they drop through.

Pumping problems developed at once and it



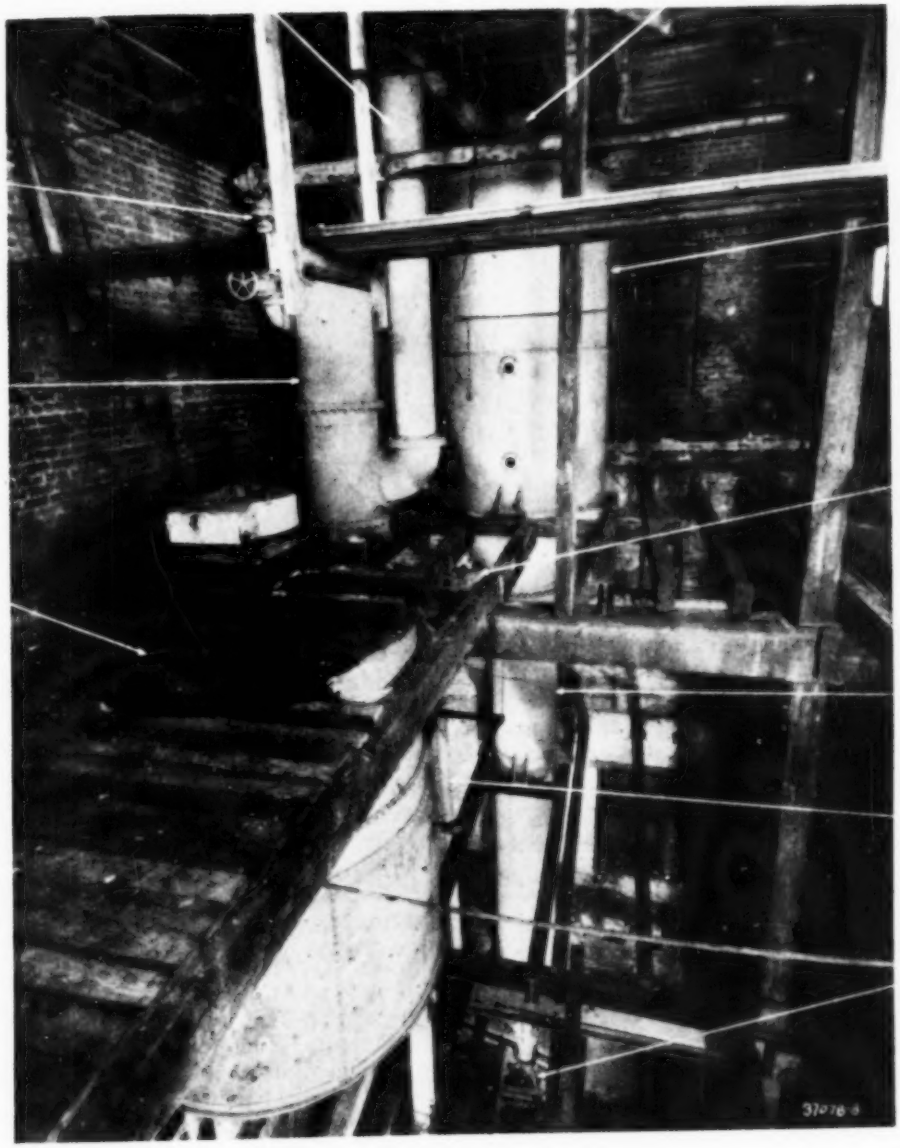
CIRCULATING RENDERING PLANT (Patents applied for)

was found necessary to reinstall the pump lines so as to overcome certain difficulties and several changes in pump design had to be made. The alterations in the pumps have not related to the proper functioning of the pumps as regards pumping. The non-clogging type impeller centrifugal pump has satisfactorily handled all the solids such as bones and meat and the foreign materials in garbage. The changes in pump design and construction were primarily to strengthen the pumps mechanically for this severe service and to keep them vacuum-tight under this service. The pumps in present use are functioning satisfactorily. Some minor changes in the original design of the equipment were also made as the development work progressed.

Results Obtained

ONE unit has now been in operation for over a year at the Chicago Plant of Darling & Company with satisfactory results. A second unit was recently installed at the Chicago Plant and has been in operation for several months. In this unit the heater is provided with tubes of 4½″ outside diameter. Two units are now being installed at the Buffalo Plant of Darling & Company.

A charge of material is rendered in about 2 hours. As compared with dry rendering the


Vapor Line From Separator (Not Shown) to Barometric Condenser
Vapor Outlet to Separator
Steam-Jet Vacuum Pump (in rear)
Flash Chamber
Barometric Condenser
Return Inlet Into Flash Chamber
Mixing & Heating Tank
Heater
Return Line From Circulating Pump To Flash Chamber
Circulating Pump

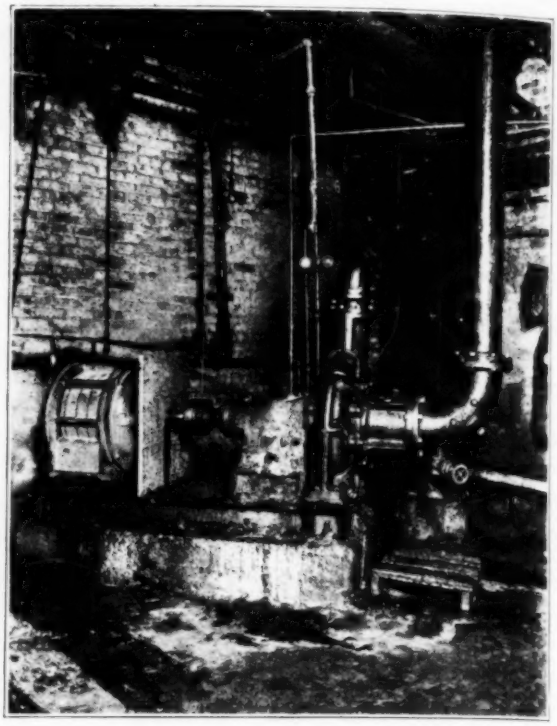
Circulating Rendering Plant

The Second Unit During Erection at Darling & Company, Chicago Plant

time varies inversely with the heating surface, with a further reduction due to better heat transfer resulting from rapid circulation. A 5′ x 16′ dry melter has a heating surface of approximately 250 sq. ft. However, the material resting on the lower portion of the shell is at no time in contact with the entire heating surface. The time of rendering a 16,000 lbs. charge is 8 to 9 hours. The Circulating Rendering Process with 1,000 sq. ft. heating surface renders the same size charge in about one fourth the time, or 2 hours. The use of exhaust steam at 5 lbs. pressure as against 40 to 50 lbs. in dry rendering lowers the heating temperature but this is offset by having the material under vacuum. In rendering, as in evaporation, the rate of heat transfer is approximately proportional to the difference in the temperature between the heating medium and the medium being heated. The forced circulation of the material over the heating surface is, of course, the chief factor in the rapid heat transfer and reduction in rendering time. The entire charge is circulated through the heating tubes approximately every three minutes.

The maximum temperature of the material is usually around 185 deg. F. and never above 200 deg. F. The vacuum runs up to a maximum of about 28″ at the finish. The color of the fat is better and the F.F.A. lower than with the old dry melters. With the lower temperature and shorter time of operation there is no formation of mucilaginous products.

Aside from the improved quality of the product there is a great saving in steam, labor and power. The heating is all done with exhaust steam which is available from the power generators. The amount of steam required varies with the moisture content of the material, but since much of the material rendered at the Darling Plant runs up to 75-80% moisture it will be readily appreciated that the total steam requirement is very high. The steam consumption is slightly under 1.2 lbs. exhaust steam at 4 lbs. pressure per pound of moisture driven off. The labor is reduced through improved handling which is facilitated by the larger batches in the Circulating Rendering System as against the old fat melters. Two Circulating Rendering Units are doing the work formerly done in ten dry melters. The power consumption is considerably less since the chief power requirement is that of the circulating pumps. On the two units installed at the Chicago Plant the circulating pumps have 30 H.P. motors. These render a minimum of 16,000 lbs. of material, each, in 2 hours. The old dry melters had 15 H.P. motors each, and it required 10 of these melters to do the same work, or 150 H.P. against the present 60 H.P. The motive power requirements may be further compared as follows: A horizontal dry melter 5′ diameter by 16′ long and driven by a 40 H.P. motor renders a charge of 16,000 lbs. of material in 8 to 9 hours. The Circulating Rendering Plant renders a charge of 16,000 lbs. material in 2 to 2½ hours and is operated by a 30 H.P. pump motor.



Circulating Pump on Circulating Rendering Plant

The Circulating Rendering Process is, as has been previously stated, operated under vacuum and all vapors are condensed in the barometric condenser. This precludes the discharge of any obnoxious vapors in the rendering of low grade inedible materials.

Since the only moving part in the Circulating Rendering Process plant is the circulating pump, there is expectation and assurance that the equipment will have a long life and that maintenance charges will be low.

The Future of the Process

THE Circulating Rendering Process is at present used commercially only on inedible materials including garbage, fat and bones.

(*Turn to page* 453)

Mayonnaise Oils, Mayonnaise and the Kreis Test

Phloroglucinol Reaction Said to be of Value As Indication of Acceptability of Oils for Salad Dressings

By A. G. Olsen *and* C. A. Southwick, Jr.*
Research Department, General Foods Corp.

IN point of percentage composition vegetable oil is the most important component of mayonnaise. According to the Federal Standard** the latter must contain not less than 50% oil and in some commercial formulæ it makes up over 80% of the product. The vegetable oils used are relatively unstable, oxidative changes readily occur and once started rapidly reach the stage where the flavor and odor are such as are described by the term "rancid", that is the oils are no longer edible.

To the mayonnaise manufacturer the *chief* concern is not to guard against the use of such inedible oil, but to guard against the buying of oil which might reach that stage, either while in stock or in the form of mayonnaise before being consumed. That is, it is not the question of whether a given oil is sweet and edible but rather, how long will it remain in that condition? How to test this has been the cause of much research and even more controversy. Undoubtedly the best method is to actually observe the length of time it takes a sample of the oil in question, subjected to definite standard conditions, to develop a rancid odor. Unfortunately this involves not only too much time, but a well-trained nose. Another test is that used by Holm and Greenbank.[1] These authors measured the socalled induction period by determining the rate of oxygen absorption by the fat and used this as an indication of the keeping quality of the fat. Unfortunately their method requires apparatus too involved for routine purposes. Several new chemical tests have been suggested recently[2] but so far none have been studied sufficiently to prove them preferable to the so-called Kreis test. The latter is simple enough to be performed by an unskilled workman. Its major requirement is rigorous cleanliness to exclude contamination by oily films on either the laboratory glassware, or the sampling devices. The major criticisms of this test have been that it is not actually a test for the substances causing the rancid test or odor, but rather a test for substances that occur incidentally in the rancid fats, and that under certain conditions sweet fats will give a positive test.[3] However, under normal conditions the Kreis test, as shown by Kerr,[4] and by Kerr and Sorber,[5] enables one to describe the intensity of rancidity in terms of the degree to which the oil may be diluted with an inert or inactive diluent and yet give a definite pink reaction.† Thus an oil may be reported negative, +1 or more depending upon whether the undiluted oil is negative or positive and how far it may be diluted and yet produce a definite pink color reaction. Now if the oil were to be tested by odor or taste certainly the oil giving +1 or even +5 would be judged sweet, and would be perfectly wholesome for food purposes. In other words, on the basis of actual rancidity as discerned by the nose and the taste organs, the test is supersensitive, and this may well lead the average lay observer to question its applicability to a fair evaluation of the oil. The writers believe it might have been less confusing to others than chemists, to describe the test as one for the detection of the keeping quality of the oil. Holm and Greenbank[1] show this relationship and state "The sensitiveness of the Kreis test and its strict quantitative relationship to oxygen make it an exceedingly good measure of oxygen absorbed, other changes being excluded."

** "Mayonnaise, Mayonnaise Dressing, Mayonnaise Salad Dressing, is the clean, sound, semisolid emulsion of edible vegetable oil, egg yolk or whole egg, a vinegar or lemon juice, seasoned with one or more of the following: salt, sugar, spice, commonly used in its preparation. The finished product contains not less than 50 per cent of edible vegetable oil, and the sum of the percentages of oil and egg yolk is not less than 78."

* Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

† Details of Kreis Test. To 5 cc. sample of oil in clean test tube are added 5 cc. concentrated hydrochloric acid, and the mixture shaken 30 seconds. Five cc. of 0.1% ethereal solution of phloroglucinol are then added, and again shaken for 30 seconds, and allowed to stand until clear. Development of pink color constitutes positive tests. Blank test on reagents is required to be negative. By "Kreis Number" is meant the proportion to which a sample of oil may be diluted with petroleum ether before a negative test results.

Table 1

KREIS TEST OF OIL BEFORE AND AFTER INCORPORATION IN MAYONNAISE

Oil after Separation from Mayonnaise stored for Indicated periods at 70° F.

	Oil used Cottonseed	Initial Kreis test	Age days	Kreis Taste	Age days	Kreis Taste	Age days	Kreis Taste	Age days	Kreis Taste	Age days	Kreis Taste	Age days	Kreis Taste
1.	Non-winter ...	neg.	0	neg. O.K.	6	neg. O.K.	16	neg. O.K.	28	neg. "off"	38	neg. "off"		
2.	Winterized ...	neg.	0	neg. O.K.	6	neg. ?	16	? "off"	28	neg. "off"	38	neg. "off"		
3.	Winterized ...	6	0	4 O.K.	9	neg. ?	21	neg. O.K.	31	4 "off"				
4.	Non-winter ...	3	0	O.K.	10	neg. "off"								
5.	Winterized ...	22	0	"off"	10	15 Rancid								

On this basis therefore, we considered the Kreis test to be useful, although there remained to be determined whether for practical purposes a negative Kreis test was absolutely necessary. To test this question we obtained several samples of refined cottonseed oil ranging in Kreis test from strictly negative to a positive 22. Mayonnaise was prepared with each of these. Two series of observations were made, first, a comparison of the taste of the mayonnaise with the Kreis test of the oil separated therefrom, and second, a correlation of the rate of development of stale flavor in the mayonnaise with the original Kreis test on the oil as used. In each case the oils were tested just before being used and periodic observations were subsequently made until a definite stale or "off" oil flavor had developed in the mayonnaise.

Experimental

AS STATED above two types of observations were made (a) to correlate the Kreis test on oil separated from a mayonnaise with the actual condition of the mayonnaise at that time, as determined by taste and odor; and (b) to correlate the Kreis test of the oil as used with the taste and keeping quality of the mayonnaise made with it.

When oil is incorporated into mayonnaise it is no longer just cottonseed oil, or corn oil, as the case may be, but a mixture of such an oil with the oils and other fatty substances from the egg yolk and from the spices. The emulsifying process causes it to come into intimate contact with an acidified aqueous surface well saturated with atmospheric oxygen. Whether under these circumstances the changes produced in the oil are at all related, and in what manner, to the changes which such an oil normally undergoes, is not known.

We tested this point by comparing Kreis test of the original oil with the same test on oil after having been incorporated into mayonnaise, and we also compared the onset of stale or "off" oil flavor with the Kreis test. We used two lots of negative cottonseed oil kindly furnished by Procter & Gamble Co., as well as several samples of oil of varying degrees of rancidity, as determined by the Kreis test. In each case the Kreis number was determined just prior to preparing the mayonnaise. Subsequently the mayonnaise was stored in clean 3½ oz. glass jars and at intervals samples were removed to be tasted and then frozen to obtain a clear separation of oil for use in determining the Kreis number. The results are given in Table 1.

There is but one conclusion to draw from Table 1, namely, that the Kreis test on oil separated from mayonnaise bears no relationship to the staleness of the mayonnaise. Unless the oil is very bad no positive test is obtained. Additional observations were made to determine the rate of staling of mayonnaise made with these different oils. The results are shown in Table 2.

Table 2

RELATION OF KREIS TEST OF OIL TO DEVELOPMENT OF "OFF" FLAVOR IN MAYONNAISE

Batch Number	Kreis Number of oil used	Type of oil (Cottonseed)	Latent Period or Approx. time to develop "off" oil taste in Mayonnaise Storage at 70° F. in light. Days
1	negative	non-winterized	28
2	negative	winterized	16
3	3	non-winterized	10
4	6	winterized	31
5	8	winterized	8
6	20	winterized	0
7	22	winterized	0

The length of time in days, from the preparation of the mayonnaise until the latter develops a definite "off" or stale oil flavor, we have termed the *latent period*. It seems proper to conclude from Table 2, that as the Kreis test color of the original oils increased in intensity the shorter was the latent period, that is, the more rapid was the subsequent development of undesirable flavor in the mayonnaise. Thus there is a definite advantage in purchasing oils giving a negative Kreis test. While this condition represents the ideal, it is still possible to use oils having low Kreis numbers with satisfactory results. For our own purposes we believe that +4 should be regarded as the upper limit of acceptability, and such oils should be used only on relatively rare occasions. For safety the major shipments of oil should be below this Kreis number and preferably, Kreis-negative.

At present our observations are not extensive enough to be definitely conclusive, yet they provide, we believe, enough data for drawing a rough curve of the life expectancy of mayonnaise from the standpoint of fresh sweet flavor. This curve is shown in Figure 1. Actual length of time that a given sample will remain fresh of course, will differ with conditions of storage but we feel warranted in making the following general conclusions:

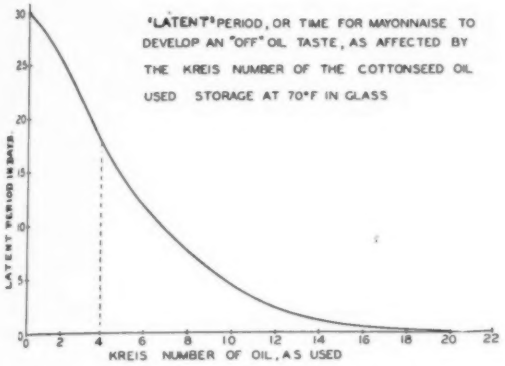

"LATENT" PERIOD, OR TIME FOR MAYONNAISE TO DEVELOP AN "OFF" OIL TASTE, AS AFFECTED BY THE KREIS NUMBER OF THE COTTONSEED OIL USED STORAGE AT 70°F IN GLASS
LATENT PERIOD IN DAYS.
0
5
10
15
20
25
30
0 2 4 6 8 10 12 14 16 18 20 22
KREIS NUMBER OF OIL, AS USED

Fig. 1

1. The Kreis test is of no value in following rancidity changes in oil *after* its incorporation into mayonnaise.

2. Despite its empirical nature and its practical shortcomings the Kreis test should be retained as a rapid test which gives some indication of the acceptability of oils for mayonnaise. Oils with Kreis numbers up to about +4 may be regarded as acceptable. This, however, should be regarded as the upper limit of acceptability, or even bordering upon the danger zone. For safety the major shipments of oil should be Kreis-negative.

3. *Latent* period is defined as the time in days for mayonnaise to develop an "off" or stale oil flavor. The greater the Kreis number of the oil, the shorter the *latent* period of the mayonnaise.

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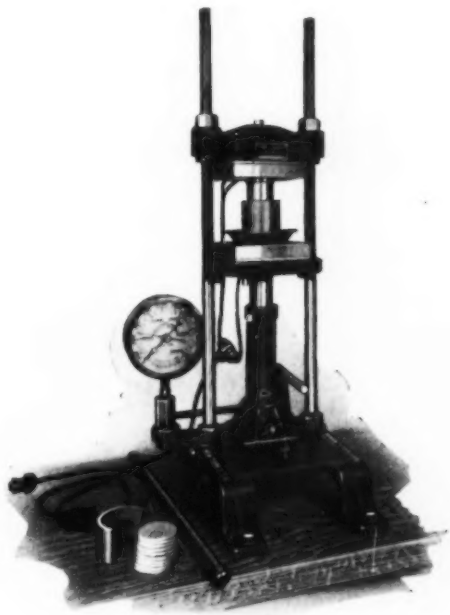
[3] See for instance, Kerr, R. H.; J. Ind. Eng. Chem. 10 (1918) 471 and Smith, W. B.; J. Ind. Eng. Chem. 12 (1920) 764; also Powick, W. C., J. Ind. Eng. Chem. 15 (1923) 66 and J. Agr. Res. 26 (1923) 323-62.

[4] Kerr, R. H.; J. Ind. Eng. Chem. 10 (1918) 471.

[5] Kerr, R. H. and Sorber, D. G.; J. Ind. Eng. Chem. 15 (1923) 385.

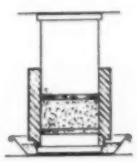


Laboratory Hydraulic Press

Fred S. Carver, 345A Hudson Street, New York City, has recently perfected a laboratory type of hydraulic press, especially designed to obtain hydraulic oil from samples of oil-bearing seeds and nuts, for determination of free fatty acid percentage in such oil or for other analyses.

The Carver Laboratory Press is equipped with electrically heated platens and with special container for the accommodation of samples of cottonsed or other oil-bearing seed. When the seed is properly ground and pressed in the Carver hydraulic press, only a few minutes are required to obtain a sample of hydraulic oil for the determination of free fatty acid. Obtaining the oil in this way in the laboratory assures the chemist of a free fatty acid test on oil obtained in a manner entirely analogous to that of mill practice.

The special container is furnished complete with filter pads and oil-receiving pan and the entire assembly is neat and compact. The press and all accessories are well-machined and finished and the complete outfit will undoubtedly find a variety of applications in the oil-chemists' laboratories.



Special Seed Container for Carver Laboratory Hydraulic Press

Cottonseed meal used as fertilizer during the 12 months ending July 31, 1931, is reported by the Agricultural Economic Bureau of the Department of Agriculture to have been 215,329 tons, or about 9 per cent of the total production of cottonseed meal from the 1930 cotton crop. Manufacturers of commercial fertilizers used 76,023 tons and farmers applied 139,306 tons directly to the soil. This is an increase of about 30,000 tons used by farmers over the amount they used the previous year, the amount used in commercial fertilizers having been approximately the same both years.

The fact that cottonseed meal is too valuable as feed to be put to fertilizer purposes, is becoming generally recognized. It is not so many years ago that from 20 to 25 per cent of the production was thus used. Farmers are learning that they may feed cottonseed meal to cattle and retain over 80 per cent of its ammonia value in manure.

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Sulfation of castor oil is said to take place, in part, at the double bond; a stable gamma-hydroxy-stearic acid is not obtainable from stearolactone without first separating the stearolactone from the accompanying fatty bodies. Although determination of the actual composition of a fatty modification obtained by the action of sulfuric acid is not always possible and even though the identification of the parent oil is often difficult, one can always ascertain that modification has taken place. *Ind. and Eng. Chem. Anal. Ed.* 3,243, (1931).

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The weak point in the determination of unsaponifiable matter in fats by the wet method is said to be the contamination by soap of whatever solvent is used for extracting the unsaponifiable matter from the aqueous soap solution. It is proposed to treat the petroleum ether solution of the unsaponifiable matter with anhydrous sodium sulfate instead of washing it with 50 per cent alcohol before evaporating. *Chem. Ztg.* 55,363 (1931).

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Procter & Gamble Manufacturing Co. has filed an appeal against a recent decision of the U. S. Customs Court which held that whale oil rendering on board a Norwegian vessel in the Antarctic and brought into the United States was a foreign import and so dutiable under the 1930 Tariff Act. Procter & Gamble denied that the Antarctic was Norwegian territory and also attacked the validity of the Court's claim that ships at sea and the property in them are a part of the country to which they belong. The appellants claim that the whale oil should be admitted duty free.

In the determination of acid number and saponification number of fats, to overcome the errors due to the presence of lime soap or other metallic soaps, the following method of determining acid and saponification number is recommended: Dissolve 4-5 grams of the fat in a neutralized mixture of 90 per cent by volume of 70° petroleum ether and 10 per cent by volume of absolute alcohol; add 30 cc. of 50 per cent alcohol, then titrate the warm lower aqueous solution to permanent rose color to phenolphthalein. Determine the saponification number as usual after decomposing the fat with acid. The percentage of soaps is calculated from the acid numbers before and after decomposing the soaps in the fat. *Seifensieder-Ztg.* 58, 254-5 (1931).

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In making "non-freezing" lubricants, oils or fats are mixed with a glycol or with a hydroxyl containing ether of a glycol and a dispersing agent such as soap, a high-molecular-weight sulfonate or an alkylolamine; for example, a mixture of spindle oil and tallow, colophony or paraffin oxidation products is mixed with ethylene glycol, borax, benzyl alcohol and an aqueous potash solution to form homogeneous product suitable for lubricating locomotive axles, electric contacts, rail switches, etc., or for use in hydraulic presses or brakes or as a rust preventing coating. Brit. Pat. No. 240,294.

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The oxidation of fats is accelerated sensibly by weak artificial light, while exposure to direct sunlight for a few minutes suffices to produce rancidity. The reaction is autocatalytic, and even brief exposure to light accelerates the subsequent oxidation. Bleaching of the lipochrome of beef fat occurs at a comparatively early stage of the oxidation process. A distinct parallelism exists between the active oxygen content of a fat and the intensity of its response in the Kreis reaction, but at low temperatures the content of active oxygen increases more rapidly than the ability to respond to the test. In bright sunlight, the reverse is true. *Proc. Roy. Soc.* (London) B108, 175-89 (1931) *Chem. Abstr.* 25, 4424 (1931).

■

The composition of the fat of sow milk is approximately: oleic acid 64.5, palmitic 26.6, myristic 2.6, volatile acids, (caprylic and caproic) 1.4, glycerol 4.9%. *Ann. fals.* 24,87-8 (1931).

Origin, Properties and Uses of Activated Carbon

By J. WRENCH*

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OF THE elements that make up matter, carbon is one of the most common, ranging in character from the costly diamond to coal worth but one to two dollars per ton at the mine. Its uses in one form or another are manifold. Richter's Lexicon, as far back as 1910, listed 170,000 different carbon compounds. However, the present purpose is to refer to only those forms of carbon known to possess purifying properties. These include wood charcoal, bone charcoal, activated carbons. The first two are derived from the dry distillation of wood and animal bones respectively. The latter is produced by means of patented processes from a variety of raw materials, embracing wood, sawdust, peat, rice hulls, corn husks, lignite, molasses, coconut shells, fruit kernels, waste liquors, etc.

As far back as the early Fifteenth Century, it was discovered that wood charcoal possessed some power of removing coloring matter from solutions, but it was not until the close of the Eighteenth Century that this property was put to practical use. The use of wood charcoal in medicinal preparations for man and beast is still practiced. It has served effectively as an adsorbent of sick room odors and during the pioneer days of this country, it was used as a purifier of stagnant water in cisterns and water in wells that had become fouled. The old gold prospectors in Australia threw the wood ashes from their fires into stagnant water as a primitive means of purifying.

Research, following the use of wood charcoal as a purifying medium, disclosed that carbon of animal origin was superior in this respect, resulting in the manufacture of bone charcoal from the bones of animals—a product low in actual carbon content (10%), spread over a porous structure composed of tricalcium and related phosphates. In the middle of the last century, bone charcoal was introduced into the refining of sugar and is still one of the standard processes.

The product now known as activated carbon is currently described as a form of carbon possessing adsorptive properties, giving it power to attract and retain to itself impurities from any liquid with which it is brought into contact. Thus, you will note a simple physical action—and not a chemical reaction—is what takes place. One can hardly imagine a simpler process of purification. Is it strange, therefore, that it is fast replacing the old style purification methods depending upon chemical reactions which, instead of removing the impurity, change its status only, leaving one never sure it won't revert under certain conditions.

ACTIVATED carbon is supplied in an acid, alkaline or neutral condition and in the form we know it today, originated in Europe about thirty years ago, where it was manufactured on a small scale, utilized mostly in the purification of drug and pharmaceutical products, and later applied to the purification of beet sugar. It was not then referred to as such, but offered under various brand names. As a trade term, activated carbon was first applied during the war, following its development as a protective means against poison gas attacks. Again, the remarkable adsorptive properties of a carbon made "active" were recognized and its use in gas masks saved countless lives.

Up to 1912, small quantities of the high-powered adsorbing activated carbon was being imported into this country from Europe, but the use here was restricted on account of the very high cost (as much as $1.00 per lb.) mostly for use in purifying high-priced drug and pharmaceutical products. About this time, it was introduced to the producers of raw cane sugar in Louisiana and a number of the southern planters installed a refinery process at their raw sugar mills, representing a revolutionary idea in sugar refinery practice.

Broadly, the activation processes normally involve calcination and carbonizing under controlled conditions as to atmosphere, tempera-

* Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

ture, and in certain cases carrying on the calcination process in the presence of an inorganic compound to serve as a spacing medium; also, the use of steam, CO_2 and other gasses, all with the object of securing porosity which is generally considered coincidental with adsorption efficiency. Activated carbons are divided into two classes, functioning more or less distinctly—one, in the removal of color and odor existing as impurities in liquids; the other used as an adsorbing medium to collect, recover and purify gases. The gas-adsorbing carbons originated during the great war, of which mention has already been made. They served effectively for the adsorption and elimination of toxic gases, for which no chemical protection exists. In peace times, this same type of activated carbon is used successfully in the recovery of valuable vapors of volatile liquids, the extraction of casinghead gasoline from natural gas and as a purifier of fermentation gases employed in carbonated beverages. It is also used in gas masks that serve as safety appliances for fighting fire, coal mining, etc.

For gas purposes, a dense or compact form of carbon is preferred because of its greater capacity to adsorb the largest volume of gas in the least volume of carbon; hence the use of carbonized coconut shells as one of the preferred raw materials. Fruit pits serve equally as well. Perhaps some of you remember back in 1917 and 1918, the barrels in front of the movie houses in which you were asked to drop your old peach pits. These same peach pits, charred and activated, surely "did their bit." I believe it is now well recognized—and certainly it has been our experience—that the gas-adsorbing carbons do not serve as good decolorizers and it is the exception for the decolorizing type of carbon to be effective as a gas-adsorbing medium.

REMINISCENT of the early days of manufacturing development, we were naturally anxious to arrive at some standard method of evaluation, for the purpose of controlling and maintaining quality standards. There existed no authority, either in person or reference book, to consult and we were without compass to guide our course in this respect. Finally, we resorted to what our laboratory termed the K. V. Test, which meant that we took a petroleum base oil to which was added a standard red dye — Soudan Red III, in a carefully measured quantity, to furnish a master color solution. This, we made our indicator for color removal. It worked very well for a while, particularly on the vegetable oils; the increased decolorizing efficiency secured by improving the activated process reflecting itself on this K. V. scale. Then, we tried applying it to glycerine and ran into our first experience of the selectivity of these carbons — a well recognized principle today. With the development of our product for sugar refining, we devised a method of evaluation, utilizing a molasses solution, which acts as a correct barometer for many purposes, but does not give the complete answer though it still remains one of our standard methods of evaluation. Methylene blue and caramel are other mediums but we have reached the conclusion, that due to the distinct selectivity of activated carbons, there can be no common yardstick with which to measure decolorizing quality. To a great extent, one must function like a custom tailor and fit the product to the individual needs of the customer, As an example, take your cottonseed oil, which may be considered a pretty staple product. We had cases where samples of this oil, taken from different localities, have each required a different quality of carbon. Carbons evaluated upon one type of product seldom show any parallelism when tested on a different type of product. In many cases, other materials than coloring matter take part in the equilibrium reaction between carbon and coloring matter. In still other instances, the pH of the carbon has a great deal to do with its decolorizing power and an adjustment in this respect is necessary to give the best results. Adding to the carbons some percentage of other adsorbing or decolorizing mediums, such as bleaching clay, often has given better results in the combination than has been obtained with either clay or carbon alone. You are already familiar with this phenomena by the practice of using fullers' earth with the carbon, which we recognize must be attractive because at its low cost, it represents good decolorizing value; the carbon functioning more to give the oil the desired quality edge and thus the maximum market value.

I have already mentioned that you technical men representing an industry, itself created by research and now one of the largest and most progressive industries in the country, were the first to recognize the merits of activated carbon: thus are more conversant with it than anyone else and consequently its application to oils and fats is familiar to you. But, it may not be amiss to summarize the advantages of activated carbon to vegetable oil manufacture as follows:

(1) Removes colloidal impurities from crude oils of all kinds, which reduces refining losses by removal of bodies that tend to emulsify free oil into soap stock.

(2) Possesses strong power of red color removal.

(3) Stabilizes oils (a) keeping free fatty acids to a minimum throughout processing, (b) keeping color and odor from reverting after processing, particularly in process of deodorizing completely.

(4) Removes "bloom" in case of mineral oil or other such contamination.

In closing this summary, I do not think it is out of place to mention, that while most, if not all, of the activated carbons are offered as both decolorizing mediums but few show any marked deodorizing action. As a deodorizer, certain carbons are as definitely powerful as they are decolorizers—not an unimportant factor when considered in connection with the refining of high grade edible oils. This contention is well established in the dry cleaning industry where carbon is used in the recovery of the naptha or gasoline, fouled with dirt, grease, etc., etc. Another recent example is fruit juice, possessing objectionable green color held very stubbornly in the liquid.

The manufacture and development of activated carbon must be accepted as a very definite contribution to the industrial manufacturing art, the actual extent of which cannot yet be estimated. As a modern purifier, it has expanded tremendously, horizontally in the variety of uses and perpendicularly as to the volume of consumption. While it can not truly be said that activated carbon has yet met *all* the demands made upon it; since its inception vast strides have been made in the elevation of its power and effectiveness. Relatively, it is still an infant industry; and as the demands made upon it are advanced and the need for it arises in still other fields, one can safely venture to predict, qualities will be made available to satisfy the need.

A BRIEF survey of the progress of use, so far, includes your own industry in which you have the responsibility of furnishing quality standards to comply with the pure food laws. Other products purified with activated carbon include: refined cane, beet and corn sugars; glucose, maple, sorghum and canning syrups; fruit juices, pectin, gelatine, glycerine, vinegar, phosphoric, citric, lactic and tartaric acids; inorganic chemicals, drugs, pharmaceuticals, solvents, milk sugar, wines, iodine and bromine recovery, dry cleaners solvent and most recently drinking water.

So much of interest has developed in the water field during the past year, that I feel sure you will not object to my dilating a little on the subject. The presence of bad tastes and odors has been giving water works operators trouble and worry for many years. Taste and odor conditions during the drought last year were just terrible and demanded a remedy. Probably, you know that most water for drinking purposes is treated with chlorine to make it safe in respect to basteria. Probably some of you have had occasion to, or must drink this chlorine-treated water. The worse the condition of the water, the more chlorine must be added which usually means pre-chlorination, post-chlorination or super-chlorination. The water people must play safe under control of the State Departments of Health. To any one who has had to drink water with the chlorine taste, I don't have to ask how he feels about this safe "water." The chlorine taste is bad enough but when you get chlorophenols, that is the proverbial "last straw."

The first attention paid to activated carbon in the municipal water field was in granular form, but this involved radical changes in water works' practice, as well as a very heavy capital outlay. Powdered carbon was first tried on a regular plant scale at Hackensack, late in 1929, utilizing the plant facilities as they existed, including a dry feed machine, already in use for chemicals. Organized introduction was only undertaken during this year and its reception has been remarkable. I can do no better than to quote from a recent paper, written and read by Mr. F. H. Waring, Chief Engineer of the Ohio Department of Health, before the Central States Water Works Association at Cincinnati a few weeks ago:

> "Summarizing the experiences with the use of activated carbon in the powdered form, it appears that a very valuable adjunct to water purification is now available economically for successfully removing practically all varieties of disagreeable tastes and odors that occur intermittently in most water supplies. A consideration of the grief occasioned to water works officials when such tastes and odors have occurred in the past will lead most of us to believe that the added cost over relatively short intervals of time for the addition of activated carbon in powdered form, $1.00 to $2.00 per mil. gals., is well worth the money spent. And if the consumer were consulted the fractional cost extra for the treatment would be demanded once the results were evident. From a public health viewpoint, the writer is firmly of the opinion that several times the cost shown would be warranted to prevent the lay public from losing confidence in the public water supply as a result of unpalatable drinking water. The public confidence represented by a safe and palatable drinking water must be preserved."

Already there are definite indications that carbon will find a place in the improvement of sewage disposal.

Treatment of water reminds me of the S.S. "Leviathan." At the beginning of the

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Fats and Oils as Food for Man and Microorganisms

By L. B. JENSEN*
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EDIBLE oils and fats play a very important role in our diet. Fats represent the most concentrated form of fuel for the production of body energy. More of fatty foods could be utilized to an advantage by many people since most people do not use more than one hundred grams of fats daily. The eating of slightly less than three-fourths of a pound of fat would result in furnishing the average person with enough energy to go about his duties for a day. Naturally no one can long subsist on a strict fat diet but a meal devoid of fats and fat containing foods has no "staying qualities."

If one eats a heavy meal consisting of fat-free foods he feels hungry again within a short time. A feeling of satisfaction usually results from a meal of protein and carbohydrate foods with an adequate amount of oils and fats present. This phenomenon is due to the fact that fats stay in the stomach longer than proteins and carbohydrates and retard the digestion of these foods.

Ingested fat undergoes hydrolysis through the agency of lipase (fat-splitting enzyme) secreted by the pancreas and the whole process is powerfully aided by the bile salts dispersing the oil droplets and giving rise to emulsions.[1] We have found that the electrical charge (P.D.) on each globule is greatly increased by the bile salts and thus lipase adheres more readily to its oil substrate. Hydrolysis of the glycerides is accomplished by the enzyme; soaps (pancreatic juice furnishing alkalis) are formed along with glycerol and these water soluble substances are then taken into the body. As soon as the soaps enter the epithelial cells of the intestine, they are reconverted into neutral glycerides. Both glycerol and fatty acid need not be available at the same time in the cell, since the body can provide glycerol. Hence, fatty acids can serve as food. Glycerol alone can also serve as food, but there are certain theoretical dangers attending its prolonged use in large quantities.

* Before Fall Meeting, American Oil Chemists' Society, Chicago, October, 1931.

Most of the edible oils and fats show complete absorption in the alimentary tract; the coefficients of digestibility being 96 to 100 per cent. It has been alleged and some data have been given to show that a high melting point fat, i.e., higher than mammalian temperatures, is not easily emulsified in the intestine and thus would have a lower digestibility coefficient. Drummond[2] has examined edible fats with melting points as high as 42°C. and has observed good utilization (90-94%).

WHEN the human body is considered as a heat engine and foods as fuel, we find the oils and fats heading all foods in energy value. Proteins have an energy value of 4.1 calories per gram, and carbohydrates (starches and sugar) the same energy value as protein. Oils and fats top the list at 9.3 calories per gram. The burning of ingested fat in the body spares the body proteins. Thus when a patient is considerably emaciated from wasting conditions such as typhoid fever, a high fat ("high calorie") diet is prescribed by the physician. In tuberculosis of the lungs, a high fat diet is often desirable. Fats are also useful medically in a variety of conditions, notably in epilepsy and certain types of gastric disturbances.

The theory once held to explain the nutritive value of oils and fats accounted for the value of cod-liver oil by assuming that the unsaturated fatty acids present were more readily oxidizable than an oil or fat with no double bonds. It is interesting in this connection, to recall Ivanov's observations. He found that as one goes from the northern countries towards the tropics, there is a diminishing content of fatty acids with three double bonds in vegetable oils, and that the iodine number decreased with increase of temperature during growth.[3] Perhaps the body desaturates fatty acids before oxidation, but opinion is divided as to believing that unsaturated fatty acids are more readily utilizable than saturated fats and oils.

For many years, it was thought that the oils and fats functioned in the body only as sources

of energy liberated by oxidation and the energy employed for maintenance of animal heat and for performance of work. Oils and fats were then valued in terms of calories after their digestibility had been determined. We are now aware that certain oils and fats contain properties or are carriers of principles that exert a profound effect on mental and physiological well-being.

Vitamins of Fats and Oils

IN 1907 Holst[4] described experimental studies of deficiency diseases. The subject of faulty diets had always interested seafaring peoples and it had long been common knowledge in Northern Europe that cod-livers and cod-liver oil were to be given in rickets. Johannesen[5] said that the people of Norway were so well acquainted with rickets that they never consulted a physician but treated it themselves with doses of cod-liver oil.

The lesson of fat starvation had to be learned over and over again before men began to compare notes. Explorers for a thousand years had experienced deficiency diseases. The condition of fat starvation was not made known to the world at large until 1888 when Nansen wrote his account of the first crossing of Greenland. The pemmican prepared for him was devoid of fat, and towards the end of his travels on the ice, he was in great distress. His hunger was not stayed by eating enormous quantities of the fat-free food and his distress was extreme. This condition was merely the first stage of another deficiency disease. Unfortunately, we saw all stages of food deficiency diseases in Central Europe during the war and after.

In 1913, Osborne and Mendel[6] observed a characteristic eye disease in their test animals deprived of fat in their diet. The simple addition of butter or cod-liver oil sufficed to cure or prevent the condition. Beef-fat possessed the property to a lesser extent, but lard or cottonseed oil were without effect. The principle was afterwards designated vitamin A—fat soluble.

Vitamin A (Fat Soluble): Test animals kept on a diet free from the vitamin known as "fat soluble A" may, after a time, develop the following conditions:

1—*Xerophthalmia or Ophthalmia.* (An abnormally dry condition of the eyeball; severe inflammation of the eyes, severe cases leading to atrophy and blindness. The lacrimal gland fails to function.
2—Inhibition of growth.
3—Increased susceptibility to bacterial invasion through weakened epithelial tissues.
   (a) Abscesses at the base of tongue.
   (b) Inflammation in ears and sinuses.
   (c) Infections of lungs, skin and bladder.
4—Increased absorption of bacteria (of toxins?) through the intestinal wall. In these conditions bacteria pass through the mucosa into the body.[7]
5—Failure in ovulation.

Fortunately, the body can store vitamin A for future needs. However, vitamin A should be fed in sufficient amounts at all times. Feeding tests have shown increasing benefits throughout succeeding generations in the continued use of large quantities of vitamin A-containing foods.[8] The ingestion of rancid fats and oils may completely dissipate all of the stored vitamin A in the body. Oxidation destroys vitamin A. Oils and fats containing vitamin A are listed below according to their decreasing strength in this principle:

Cod-liver oil	++++	(highest activity).
Butter (summer)	+++	under 5% sufficient
Fish liver oils	+++	to prevent conditions
Whale oil	+++	listed above.
Cream	++	
Beef fat	++	20% sufficient to pre-
Palm oil	++	vent conditions.
Corn oil (yellow)	++	
Oleo oil	+	
Oleo oil margarine	+	50% and more re-
Soy bean oil	+	quired in diet.
Cottonseed oil	±	
Olive oil	±	present in small
Coconut oil	±	amounts.
Peanut oil	±	
Vegetable oil margarine	—	
Refined lard	—	usually absent.
Hydrogenated oils	—	

We must now pass on to another group of conditions brought about by lack of vitamins found in fats and oils other than fat soluble A. (The water soluble vitamins B and C are not usually found in oils or fats.)

The Antirachitic Vitamin D: It was shown that butter rich in vitamin A tends to prevent xerophthalmia but has no effect on the calcium metabolism so that lime salts are not given to the developing bone. The investigations of Mellanby in England and McCollum and his coworkers in America demonstrated that cod-liver oil contained a vitamin distinct from A and this new antirachitic substance was designated vitamin D. Later it was shown that the favorable effects upon bone growth through exposure to sunlight or ultra-violet light were identical to the effects produced by vitamin D. When certain food materials containing ergosterol are subjected to ultra-violet irradiation, the ergosterol becomes a powerful antirachitic agent. This compound is found in the skin, hence the favorable action of sunlight or ultra-

violet light may be due to the formation of vitamin D in the skin.

The following list of fats containing vitamin D are taken from Bills' paper[9]:

	Relative D Content
Puffer fish liver oil	1,500
Cod-liver	100
Shark liver	75
Catfish liver (Ohio R)	40
Seal blubber	Nil to 3
Whale blubber	Nil
Veal fat	Nil
Oleo oil	Nil
Coconut oil	Nil
Cottonseed oil	Nil
White corn oil	Nil
Olive oil	Nil
Peanut oil	Nil

Vitamin E (Fat Soluble): Vitamin E, the antisterility and reproductive principle, resembles A and D in some respects, but is absent from cod-liver oil and present in most vegetable oils. The oil of wheat germ is one of the richest sources of this vitamin. Vitamin E is present in animal fat and the body stores E to some extent.

It was mentioned before that the lack of vitamin A causes failure in ovulation, whereas in the absence of vitamin E, ovulation takes places but the placenta does not function properly and resorption of the embryo takes place.

The following animal and vegetable fats prevent these conditions: wheat germ oil, milk fat, cottonseed oil, hydrogenated cottonseed oil, leaf lard.

Most vegetable and seed oils contains the vitamin, but not in very high concentration. Coconut oil, olive oil, walnut oil, peanut oil, flaxseed oil, etc., are without effect except in large doses.

There are still other rôles played by oils and fats in nutrition. Burr and Burr[10] found that by excluding all fat from the diet of white rats a diseased condition of the tails resulted. This condition has often been noticed in colonies of white rats. The extremity of the tail becomes necrotic and curled. Then the tail sloughs off until only a stump remains before the condition becomes self limiting. The Burrs cured and prevented this condition in their test rats by adding 2% of unsaturated fatty acids to the basal ration. They further noticed that degeneration of the kidneys resulted during fat starvation, and a new type of sterility affected the rats. All of these conditions could be cured and prevented by the addition of 2% of unsaturated fatty acids to the diet. Saturated fatty acids were without effect. The addition of 5% of lard to the diet may act as a preventive of the conditions described by the Burrs.

It was also our experience to observe "ring tail" in rats in certain strains of our rat colonies. The tails of six sucklings in one litter of eight white rats showed the characteristic tail degeneration described by the Burrs. The diets were always rich in fat and unsaturated fatty acids (5% lard, 5% butter). The defective offspring were inbred for two generations and in each generation two "ring tail" defectives appeared in litters of eight and six, respectively. When a normal strain was introduced into the "ring tailed" stock, the progeny became free from stigmata and have continued so for six generations.

Microörganisms in Vegetable and Animal Fats

THE microbiology of butter is a subject too broad in scope to include in this talk. Aside from the dairy industry, microörganisms are never of much consequence in the oil and fat industries. Most oils and fats are not liable to microbiological deterioration like the putrefactive and fermentative processes in proteins and carbohydrates held under adverse conditions. Bacterial decomposition of oils and fats rarely takes place, and then only under exceptional circumstances. These conditions need never occur in any refinery. There are certain races of bacteria (non-pathogenic) which occasionally are found growing in vegetable or animal fats. These microörganisms elaborate a fat-splitting enzyme (lipase) often accompanied by an oxidizing enzyme. Microscopical examination reveals the bacteria as gram-positive, sporing rods. Respiration experiments prove these forms to be fixers of nitrogen.

Grossly mishandled shortenings of vegetable and of animal origin occasionally show discolorations. In case of pink discolorations the inciting agent may be either a pink torulae ("pink yeast") or one of several species of molds. A few species of bacteria have been found to discolor fats. These torulae, pink-producing molds and bacteria retain their pigment-forming characteristics even after prolonged cultivation on agar. That is to say, they soon appear colorless on agar but inoculated to any vegetable oil or fat they at once regain the power to elaborate pigment. All three types of these microörganisms hydrolyze all kinds of fats. One curious type of pink discoloration in fats is due to a nonchromogenic torula. This yeast when grown on agar produces a cream-colored colony and in nutrient broth no pigment is to be seen. However, when a trace of any soluble iron salt is added to the medium, a red color is produced. The iron content of most commercial oils and fats

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Composition and Polymerization of Chinese Wood (Tung) Oil*

Elaeostearic Acid Content Cited as Measure of Commercial Utility and Purity

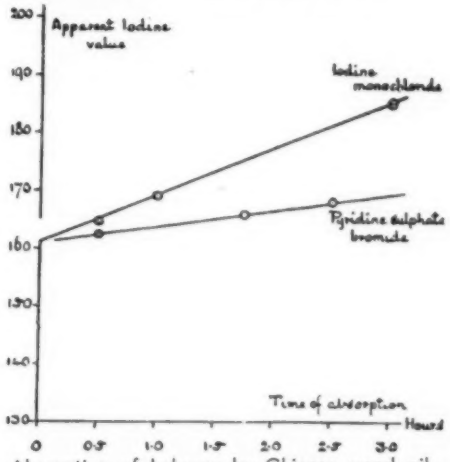
By E. R. Bolton *and* K. A. Williams

In a previous communication (*Analyst*, 1926 *51*, 335) we have described a method for the determination of the polymerisable matter in Chinese wood oil, and have shown that the proportion varies within such narrow limits (70 to 74 per cent.) that its determination affords a satisfactory criterion of the purity of an oil. We have further suggested the proportion of polymerisable matter to be a measure of the commercial value of the oil.

During the past 4 years we have had further opportunities of examining a large number of samples, with results in confirmation of those given in our original communication.

Chinese wood oil is characterized by containing a large proportion of glycerides of elaeostearic acid, to which its power of polymerizing to a solid mass is due. It seemed to us, therefore, that if a correlation of the commercial value of the oil and the proportion of elaeostearic acid could be established it would provide a more satisfactory basis for the assessment of the commercial value than the general consideration of conventional constants that is at present customary. It was on this account that we sought to establish a relation between the proportions of polymerizable matter and elaeostearic acid in the oil; and we have succeeded in showing that these two quantities are, within experimental error, the same for every oil in which we have so far determined both.

Determination of Elaeostearic Acid.—Of the methods available for the determination of elaeostearic acid that described by Toms (*Analyst*, 1928, *53*, 69) has yielded results which we believe to be more consistent and accurate than any other yet published. This method is based on the assumption that a molecule of elaeostearic acid absorbs 6 atoms of bromine from bromine vapour, but only 4 atoms of halogen from Wijs iodine monochloride solution, and that all other fatty acids present absorb equivalent proportions of halogens from both reagents. While there seems to be no doubt that exactly 6 atoms are absorbed from bromine vapour, it is generally recognized that the absorption from Wijs solution, as usually applied, is by no means so simple as Toms has assumed, the iodine value usually obtained representing the absorption of rather more than the 4 atoms required by theory. Thus, Boughton (Seventh Int. Congr. Appl. Chem., London, 1909) has shown that the apparent iodine value of Chinese wood oil depends upon such experimental conditions as temperature, time of contact of oil and reagent, and concentration of the halogenating solution. It follows that Toms' method leads, in general, to low values for the proportion of elaeostearic acid in Chinese wood oil.



Absorption of halogen by Chinese wood oil.

Determination of True Iodine Value of Oil.—Böeseken (*Rec. Trav. Chim.*, 1927, *46*, 619) has observed that the four outer unsaturated carbon atoms, in the conjugated system in elaeostearic acid, are saturated with halogen by means of Wijs solution within 15 minutes, whereas the remaining two unsaturated atoms in this conjugated system become saturated only after many hours' contact with the reagent.

This observation would appear to indicate that the iodine value corresponding to the absorption of 4 atoms of halogen per molecule of elaeostearic acid could be obtained by limiting the action of the Wijs reagent to a very short period, say, less than 5 minutes. We

* Reprinted from *The Analyst*, Vol. IV, No. 651.

have found such a method to give satisfactory Chinese wood oil, but, with others, consistent results are obtainable only when absorption is allowed to proceed for 20 minutes: figures so obtained are near enough to the true figure for practical purposes, though, admittedly, they are distinctly high.

By allowing Chinese wood oil to absorb halogen from both Wijs solution and pyridine sulphate bromide solution for varying periods of time, we have found that the first rapid stage is almost complete within five minutes, that most of the absorption is instantaneous, and that, during the second slow stage, absorption proceeds at a regular speed. This is shown in Fig. I, in which are plotted typical figures obtained by the action of the two reagents upon one specimen of the oil; the actual experimental results from which the curves are drawn are shown in Table I. In Fig. I it will be seen that the second slow stage is represented by a straight line, indicating that the increase in the apparent iodine value, during any given period of time, is constant for a given halogenating solution under the usual conditions of the determination. Since this increase is due to the slow saturation of the last two carbon atoms of each elaeostearic acid molecule, and such saturation begins as soon as the reagent comes into contact with the oil, it follows that the actual turning point of the curve may be measured by extrapolation to zero time of the straight line representing the second stage of absorption.

TABLE I.

ABSORPTION OF HALOGEN BY A CHINESE WOOD OIL

Reagent.	Time of contact of oil and reagent. Hours	Apparent iodine value.
Wijs iodine monochloride	0.5	164.5
	1.0	169.0
	3.0	185.0
Pyridine sulphate bromide	0.5	163.5
	1.75	166.0
	2.5	168.0

In the case illustrated the turning point occurs at an iodine value of 160.8 with Wijs solution and 161.2 with pyridine sulphate bromide, and is thus the same, within the error of experiment, for both reagents. We find that this case is typical of all absorptions of halogen from these two reagents, the slope of the line representing the slow absorption varying from oil to oil and being dependent on the reagent used, while the turning point is constant and independent of the reagent. This we consider affords very strong evidence that at this turning point the oil has absorbed a proportion of halogen corresponding to 4 atoms per molecule of elaeostearic acid.

The instantaneous iodine value may best be determined graphically from the iodine values obtained after absorption has proceeded for 30 minutes and for 3 hours, or by calculation from these two quantities by means of the expression:

"Instantaneous" iodine value $= I.V._{30\ min.} - 1/5\ [I.V._{30\ min.} - I.V._{3\ hrs.}]$ in which:

$I.V._{30\ min.}$ is the Wijs iodine value obtained after 30 minutes' absorption.

$I.V._{3\ hrs.}$ is the Wijs iodine value obtained with the same solution after 3 hours' absorption.*

Proportion of Elaeostearic Acid in Chinese Wood Oil.—The bromine value of elaeostearin corresponding to saturation of all three double bonds of the acid, is 164.8, or, calculated in terms of iodine, 261.7; and the true iodine value corresponding to the absorption of 4 atoms of halogen per molecule of the acid is 174.5; the difference between the two values, expressed in terms of iodine, is, therefore, 87.2. Since the amount of iodine monochloride absorbed by all other constituents of Chinese wood oil is exactly equivalent to that of bromine, it follows that the proportion of glyceride of elaeostearic acid present in the oil may be obtained by dividing the difference between the bromine value and the true, or instantaneous, iodine value by 87.2 and multiplying by 100.

We have used the above method to determine the proportion of elaeostearic acid glyceride in a number of specimens of Chinese wood oil in which we have also determined the proportion of polymerizable matter by the previously described (*Analyst*, 1926, *51*, 335).

In Table II we have set out the results of these determinations, and it will be seen that the amounts of polymerizable matter and of the glyceride of elaeostearic acid are the same, within a small experimental error. This being so, we feel that we are justified in the assumption that the polymerizable matter consists entirely of the glyceride of elaeostearic acid, and, consequently, we suggest that our original method of determining the polymerizable matter in Chinese wood oil determines the glyceride of elaeostearic acid.

(*Turn to Page* 454)

* Since this paper was read, Dr. Mitchell has drawn our attention to a thesis presented by van Loon, in 1929, to the University of Delft, in which the abnormal iodine values of fatty oils containing a conjugated system of double bonds is discussed. In our paper we have termed the iodine value given by Wijs solution an "apparent" iodine value, and we notice that the same phrase is used by van Loon, who approaches the problem of iodine values in a very ingenious manner and on distinctly different lines from those of our present communication."

Decolorizing Carbon Analyses and Tests

Describing in Detail Methods for Evaluation of the Quality and Effectiveness of Bleaching Carbons

By M. T. SANDERS*

(In Two Parts—Part II)

THE Bureau of Standards system of color measurement is based on the following equation:

$$N = \frac{-\log_{10} T}{0.00485\ Cb} \qquad \text{.....(4)}$$

Where N = color of the solution
T = transmittance of the solution (fraction of incident light transmitted) for light of a wave length 560 millimicrons.
C = concentration of sugar in the solution expressed as grams per cubic centimeter.
b = thickness in centimeters of layer of solution through which light passes.

The derivation of this equation may be found in "SUGAR" May 1925, pages 223 and 224, also in Technologic Paper No. 338 of the Bureau of Standards.

In Table II are given the values of—

a) 100 T (the percent of light transmitted.)
b) $-\log_{10} T$
c) $\frac{-\log_{10} T}{0.00485}$ (for use in calculating the color by the Bureau of Standards' system.)
d) $\frac{-\log_{10} T}{0.004355}$ (The Meade-Harris color units.)

TABLE II.

100 T	*—log T*	$\frac{-\log T}{0.00485}$	$\frac{-\log T}{0.004355}$
1	2.00000	412.37	459.3
2	1.69897	350.27	390.1
3	1.52288	314.00	349.7
4	1.39794	288.20	321.0
5	1.30103	268.23	298.8
6	1.22185	251.91	280.6
7	1.15490	238.10	265.2
8	1.09691	226.17	251.9
9	1.04576	215.60	240.2
10	1.00000	206.20	229.6
11	0.95861	197.65	220.1
12	0.92082	189.85	211.4
13	0.88606	182.70	203.5
14	0.85387	176.05	196.1
15	0.82391	169.89	189.2
16	0.79588	164.10	182.8
17	0.76955	158.66	176.7
18	0.74473	153.56	171.0
19	0.72125	148.70	165.6
20	0.69897	144.13	160.5
21	0.67778	139.74	155.6
22	0.65758	135.58	151.0
23	0.63827	131.60	146.6
24	0.61979	127.80	142.3
25	0.60206	124.12	138.2
26	.58503	120.60	134.33
27	.56864	117.35	130.60
28	.55284	113.98	126.96
29	.53760	110.82	123.43
30	.52288	107.80	120.07
31	.50864	104.86	116.80
35	.45593	94.01	104.70
33	.48149	99.28	110.58
34	.46852	96.60	107.60
35	.45593	94.01	104.70
36	.44370	91.48	101.90
57	.24413	50.33	56.06
38	.42022	86.65	96.50
39	.40894	84.29	93.91
40	.39794	82.05	91.38
41	.38722	79.84	88.92
42	.37675	77.67	86.51
43	.36653	75.57	84.17
44	.35655	73.51	81.87
45	.34679	71.50	79.63
46	.33724	69.53	77.44
47	.32790	67.60	75.30
48	.31876	65.72	73.20
49	.30980	63.87	71.14
50	.30103	62.07	69.13
51	.29243	60.3	67.16
52	.28400	58.55	65.21
53	.27572	56.85	63.32
54	.26761	55.18	61.46
55	.25964	53.53	59.62
56	.25181	51.92	57.83
57	.24413	50.33	56.06
58	.23657	48.77	54.32
59	.22915	47.25	52.62
60	.22185	45.74	50.94
61	.21467	44.26	49.30
62	.20761	42.81	47.68
63	.20066	41.37	46.08
64	.19382	39.96	44.51
65	.18709	38.57	42.96
66	.18046	37.20	41.44
67	.17393	35.86	39.94
68	.16749	34.53	38.46
69	.16115	33.23	37.01
70	.15490	31.94	35.57
71	.14874	30.67	34.16

* *In charge of Research and Development, Darco Sales Corporation.*

Table II (cont'd)

72	.14267	29.41	32.76
73	.13668	28.18	31.39
74	.13077	26.96	30.03
75	.12494	25.76	28.69
76	.11919	24.57	27.37
77	.11351	23.41	26.07
78	.10791	22.25	24.76
79	.10237	21.11	23.51
80	.09691	19.98	22.25
81	.09151	18.87	21.01
82	.08619	17.77	19.79
83	.08092	16.68	18.58
84	.07572	15.61	17.39
85	.07958	14.55	16.21
86	.06550	13.50	15.04
87	.06048	12.47	13.89
88	.05552	11.45	12.77
89	.05061	10.44	11.62
90	.04576	9.43	10.51
91	.04096	8.45	9.41
92	.03621	7.47	8.32
93	.03152	6.50	7.26
94	.02687	5.54	6.17
95	.02228	4.59	5.12
96	.01773	3.66	4.07
97	.01323	2.73	3.04
98	.00877	1.81	2.01
99	.00436	.899	1.00
100	.....	.....	.....

The value of T may be determined by the Hess-Ives Tintphotometer or by the use of a spectrophotometer such as the Keuffel and Esser Color Analyzer. The color of a solution as measured by a Stammer Colorimeter may also be used in the adsorption equation.

Formerly the Hess-Ives Tintphotmeter has been equipped with red, green and blue violet color filters. Now it is possible to obtain a color screen which transmits light of a wave length of 560 millimicrons. This is the wave length recommended by the Bureau of Standards for the measurement of the color of sugar solutions. The Hess-Ives Tintphotometer can be purchased equipped with a —log T scale, but if one wishes to convert the reading to the color units ordinarily used, he must refer to a table, so it is just as well to purchase one with a scale reading from zero for total darkness to 100 for the full transmission of the light.

Before the color of a solution is read in one of these instruments the solution should be filtered until sparkling clear and entirely free from suspended matter. This is important, as suspended particles which contribute nothing to the actual color of the solution cut down the amount of light transmitted by it.

In taking a reading of the color of the solution in any of these instruments, the fields should be balanced by first approaching the balance from one side and taking a reading of the scale when the fields appear equal, then approaching the balance from the other side and taking a reading when the fields again appear equal. The mean of these readings is taken as the scale reading for the solution being tested. This is done because there will be an interval of from one to five scale divisions, (depending on the transmittancy of the solution), during which there will be no appreciable change in the appearance of the fields of the instruments.

To determine the adsorption isotherm of a carbon when used with a given liquid one takes several equal portions of the liquid and treats all but one of these with increasing amounts of the carbon. The portion not given a carbon treatment is filtered and used to determine the original color of the solution. The color of each of the portions of the liquid which are treated with the carbon is measured. The "color units" removed from each of these portions, per gram of carbon used, is calculated, and the logarithm of this quotient is plotted against the logarithm of the color remaining in the solution after the carbon treatment. Instead of looking up and plotting the logarithms of these numbers, it is more convenient to use the so-called double logarithmic paper. This paper is co-ordinate paper which is graduated along each axis with a logarithmic instead of the usual uniform scale.

It is well to determine at least four points on the isotherm. As an example, let us assume that we wish to determine the adsorption isotherm of a carbon using a molasses solution.

Into each of five 250 cc. Erlenmeyer flasks measure 150 cc. of the molasses solution. Place these in a water bath and heat them to 90° C.

Take five strips of white glazed paper, each about 2 inches wide and 3 inches long. On each of these strips place one gram of Filtercel. (It is well to test the batch of Filtercel for acidity or alkalinity and if it is not neutral in its reaction to water, to either wash it until neutral or to obtain Filtercel which is neutral.) Weigh out four portions of carbon, using for instance, 0.1, 0.2, 0.4 and 0.7 grams, weighing to the nearest milligram. In weighing out these portions of carbon, one should either have the dried carbon in a stoppered weighing bottle, and in removing each portion, make no attempt to measure out exactly the amount desired, or else one should use carbon which has been allowed to come to equilibrium with the water vapor in the air, and then determine the moisture of the carbon and from this data calculate the amount of dry carbon added to each flask. Place the portions of carbon on the Filtercel on each of four of the strips of glazed paper. Add the Filtercel alone to one of the flasks,

and the Filtercel-carbon mixtures to the other four flasks. This can be easily done by slightly bending the glazed paper and allowing the mass of carbon and Filtercel to slide from the paper into the flask.

Continue heating the flasks for ten minutes after the addition of the carbon and Filtercel, shaking the flasks continuously, in order to keep the carbon thoroughly mixed with the liquid. Remove the flasks from the water bath and filter the carbon from the solutions, using ordinary 60° funnels fitted with filter paper. If the first part of the filtrate is cloudy, return it to the funnel. For color measurement, use only filtrate which is sparkling clear. Cool the filtrates to room temperature and measure the color of each. In measuring the color of the solution, choose a cell of such size that the scale readings on the Tintphotometer are not less than 10 or more than 90.

Convert the color units observed to the basis of a layer of solution one centimeter thick. This is done by dividing the observed color of the solution by the thickness in centimeters, of the layer of solution through which the light passes. Calculate the color units removed per gram of carbon and plot the isotherms.

The following example illustrates the method of recording the data and calculating the results:

TABLE III.

Grams of Carbon Used M.	Hess-Inves Scale Reading	Depth of Solution Measured	Color Unites for Depth Measured	Color Units per cm. Depth C.	Color Units Removed X	Color Units Removed per gm. Carbon X/M
0	38.7	3 cm.	85	28.3	.....	.....
0.1	49.5	3 "	63	21.0	7.3	73
0.2	59	3 "	47.25	15.75	12.55	62.8
0.4	59	6 "	47 25	7.87	20.43	51.1
0.7	78	6 "	22.25	3.71	24.59	35.1

Figure II. shows C vs. X/M plotted on logarithmic paper.

The value of K. in Freundlich's equation is the value of X/M where C = 1.

1/n is the slope of the isotherm.

This is also illustrated in Figure II.

We strongly recommend the use of isotherms in evaluating decolorizing carbons. By their use one can predict the action of a carbon on a solution with the minimum number of tests. By their use the comparison of two carbons can be readily made and recorded. The interpretation of the isotherms is easy.

Suppose we have three carbons which give the isotherms shown in Figure III. We can see at a glance that less of Carbon A. than of Carbons B. and C. will be required to decolorize the solution to any desired color within the range shown. Curves for Carbons B. and C. intersect. We know that if the final color desired lies to the left of the point of intersection, Carbon C. is more efficient than B.—if to the right, B. is more efficient than C. At the point of intersection, their efficiencies will be equal. If, therefore, we are choosing between B. and C. and all their other properties are equal, and the prices are the same, we would choose C. if

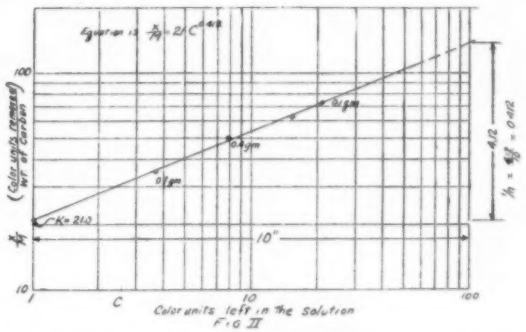


FIG II

the solution is to be highly decolorized in one treatment, and B. if counter current decolorization is to be used.

The relative amounts of two carbons which are required for decolorizing the solution to any given color can readily be calculated.

At the desired final color C. we read the values of X/M for each of the carbons. Suppose these carbons are a. and b., then—

$$\frac{\frac{M}{a}}{\frac{M}{b}} = \frac{\frac{X/M}{b}}{\frac{X/M}{a}}$$

A still simpler method is to measure the distance between X/Ma and X/Mb on the plot and transfer this distance to the scale at the side of the paper. The relative efficiencies can then be read at a glance.

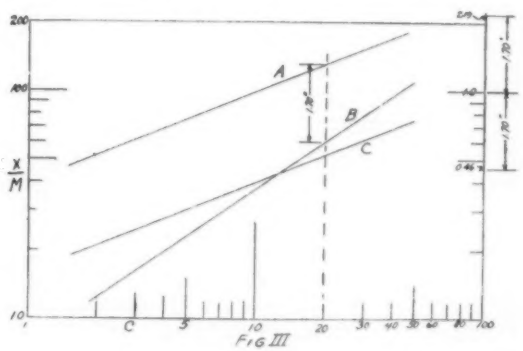


FIG III

For example, suppose we wish to find the relative amounts of Carbons A. and B. (Fig. III) which will decolorized the solution in question, to a final color of 20. At 20 we find that the curves are 1.70 inches apart. We transfer this distance to the right hand scale

as indicated, and find out that to obtain this decolorization one will have to use 2.19 times as much of B. as of A., or conversely,—0.46 as much of A. as of B.

One of the advantages of logarithmic paper is that, on it, slide rule operations can be performed with a pair of dividers.

If the constants K and 1/n for the two carbons are known, the relative efficiencies can be calculated by the following equation:—

$$\frac{M_a}{M_b} = \frac{K_b}{K_a} C^{\frac{1/n_b - 1/n_a}{}}$$

If the two isotherms are parallel $1/n_a$ equals $1/n_b$ and we have from the preceding equation:—

$$\frac{M_a}{M_b} = \frac{K_b}{K_a}$$

Therefore, if two carbons give parallel isotherms their relative efficiency is the same for all degrees of decolorization.

Merely grinding a carbon to a smaller particle size raises the isotherm parallel to itself. Several so-called "high power" European decolorizing carbons are made with as much as 90 to 95% passing through a 300 mesh screen. It is obvious that the high decolorizing power thus secured is at the expense of filtrability.

In plotting isotherms one may plot the log of the fraction of original color removed per gram of carbon against the log of the fraction of the original color remaining in the decolorized solution, but generally it is better to plot the log of the color units removed per gram of carbon against the log of the color units remaining in the solution.

The isotherm of a spent carbon is below that of the original carbon and usually is steeper. When studying the revivification of a spent carbon, the isotherm plot enables one to decide easily which of several methods of revivification brings the carbon back most nearly to its original condition.

In decolorizing vegetable oils, the isotherm is straight for a while, then suddenly bends vertically downward toward the log C. axis. The point at which this turn takes place is called the "end point" for that carbon. No more color can be removed from that oil by the carbon in question without the use of excessive amounts of carbon. On a given oil different carbons give different "end points." It is thus possible, by means of the isotherms, to determine the carbon most suitable for decolorizing the oil.

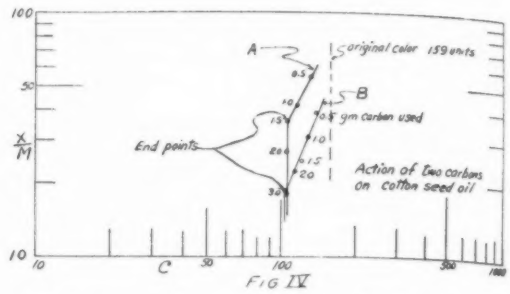


FIG IV

The reason for this change in the direction of the isotherm has not as yet been determined.

In actual practice the decolorization of vegetable oils is generally done by using a mixture of fullers' earth and decolorizing carbon. The ratio of earth to carbon varies with the oil and kinds of earth and carbon used. Generally, the earth-carbon ratio is from 90/10 to 98/2 although ratios as high as 50/50 have been used.

Figure IV shows the isotherms of two carbons on cotton seed oil (C.S.O.). The end point for Carbon A. is reached when 1.5 grams of carbon have been used. The end point for Carbon B. is at 3 grams.

If a user of carbons had been accustomed to Carbon B. and tested Carbon A. by using 3 grams of it, he would obtain the same degree of decolorization and think them of the same decolorizing ability. Actually he could have decolorized his oil just as effectively with 1.5 grams of Carbon A.

The scale of color units used in Figure IV is not that used in Fig. II.

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Fats & Oils As Food

(*From Page* 446)

is large enough to produce pink discoloration provided the fat compound contains the colorless chromogen.

Discolorations ranging from greenish-blue to purple-blue have been observed in solid animal and vegetable fats. The microbiological process involved in producing the pigments is as follows: Certain yellow-producing cocci and some races of yellow-forming bacilli grow on solid fats at temperatures ranging from 39° F. to 99° F. The yellow pigment formed by these bacteria diffuses slowly into the fat. When the fat becomes rancid and peroxides appear, the pigment assumes a greenish color which in a few days deepens into blue. The original yellow pigment appears to be an oxidation-reduction indicator and can be oxidized with the usual reagents to a greenish-blue color and reduced back to the original yellowish pigment with reducing agents. Bacterial oxidases and peroxides will effect identical changes in the pigment.

Certain mineral oils such as machine oils can support the growth of oidia and other fungi provided moisture is present. These growths are often a nuisance in constant temperature oil baths. Bacteria may be found in machine oils but never grow well in this medium. Streptococci, staphylococci and B. pyocyaneus found contaminating machine cutting oils may give rise to skin infections if the oils are not treated with a disinfectant. Oils and fats exert a weak antimicrobic action and it is a common opinion amongst bacteriologists that certain oils are good preservatives. Hall and van Meter[11] observed that the preservation of peanut butter, for example, is due to the germicidal action of the peanut oil present. They did state, however, that they believed the organism died out because of the lack of available food.

Söhngen found a number of species of bacteria capable of oxidizing petroleum, paraffin oil and other hydrocarbons.[12] In garden soils, for instance, the number of paraffin oxidizing bacteria may reach 200,000 per gram of soil. Not a few species of bacteria show the power to elaborate lipase, likewise numerous species of molds, oidia, torulae and yeast hydrolyze and oxilize fats to a limited extent. Fortunately for the industry, only a few strict lipophilic microörganisms are present in nature.

■

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■

Activated Carbon

(*From Page* 443)

year, they had been having a great deal of trouble. The condensate from the steam seals of the turbines had to be thrown overboard because of the oil it had adsorbed. This fresh water had to be bought in port, and it was thought advisable to make some use of it. Passing of the condensate thru columns of granular carbon removed the oil and made the water fit for boiler feed, without fear of "priming" or lost efficiency.

■

Circulating Rendering

(*From Page* 436)

From the standpoint of the physical condition of the material and the problems involved in handling, edible materials are more easily rendered by this process than the inedible. Several tests have been made on edible materials with satisfactory results.

With the present experience there is no other possible conclusion than that the Circulating Rendering Process is universally applicable for rendering on a large scale. Its use will result in improved products and considerable simplification and economy in operation.

■

Position Wanted: *Manager*—Sales Manager or General Manager, margarine, compound, salad oils, coconut butters, any edible fats. Address Box M52, *Oil & Fat Industries*, 136 Liberty St., New York.

■

Position Wanted: *Chemist*—Has recently developed a new process for decolorizing and bleaching beeswax, also applicable to some oils and fats; desires permanent position. Address Box No. D71, *Oil & Fat Industries*.

Chinese Wood Oil

(*From Page* 448)

TABLE II.

PROPORTIONS OF ELAEOSTEARIC ACID AND POLYMERIZABLE MATTER IN CHINESE WOOD (TUNG) OIL.

		Iodine value			Bromine value. Toms' method	Glyceride of elaeostearic acid, calc. from bromine and iodine values Per Cent	Polymerizable matter (Bolton and Williams' method) Per Cent
		Half-hour.	Three hours.	Instantaneous value			
Pure Oils:	1.	168.5	175.5	167.1	229.0	71.0	70.0
	2.	165.4	175.7	163.3	226.2	72.2	71.5
	3.	162.0	169.2	160.6	223.8	72.5	71.8
	4.	166.5	176.2	164.6	228.2	73.0	73.0
	5.	169.7	174.8	168.7	223.2	74.0	73.0
	6.	166.6	178.1	164.3	228.5	73.6	74.7
Adulterated oil containing approx. 15 per cent. soya bean oil		161.6	169.0	160.1	221.2	58.7	58.1

The method which we have described in this communication requires very careful manipulation, particularly with regard to the weighing of the brominated compound, and for this reason we feel that it is less simple to operate than the determination of the polymerizable matter.

Conclusion.—From the results put forward above, the following conclusions may be drawn:

(1) Elaeostearic acid glyceride may be determined in Chinese wood oil by the separation of the polymerizable matter previously described by us (*Analyst,* 1926, *51,* 335).

(2) If the iodine value of elaeostearic acid is to be defined as the percentage of halogen in terms of iodine absorbed by exactly four of the unsaturated carbon atoms—the absorption by the remaining two being entirely excluded—then this figure may be obtained with sufficient accuracy for practical purposes by an absorption limited to 20 minutes, or, where great accuracy is required, it may be obtained by the more elaborate method described in this communication.

Our thanks are due to Mr. W. J. Newman for his assistance in the analytical work.